RADIO and ELECTRICAL Review

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NOVEMBER 1st, 1956

VOL. 11, NO. 9

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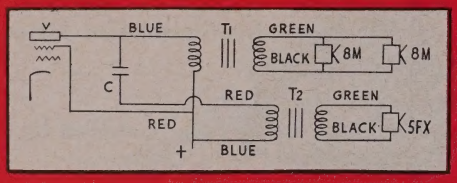

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6V6, 6AQ5, 6BW6, A Pentode 5,000 ohm load
T1 : CBG58 ; T2 : EHL32 ; C : .008 mfd.

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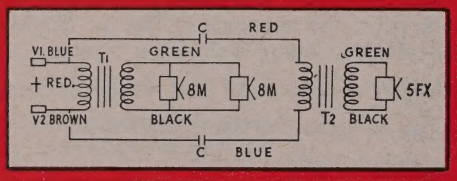

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6V6, 6AQ5, 6BW6, Al P.P. Pent. 10,000 ohm load
T1 : COL38, T2 : ECL68 ; C : .006 mfd.
6BV7, 6M5 Al P.P. Pent. 7,000 ohm load
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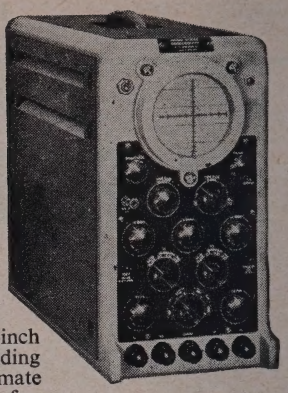

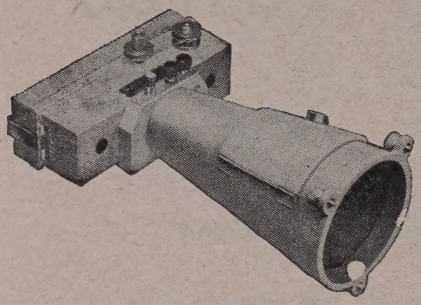

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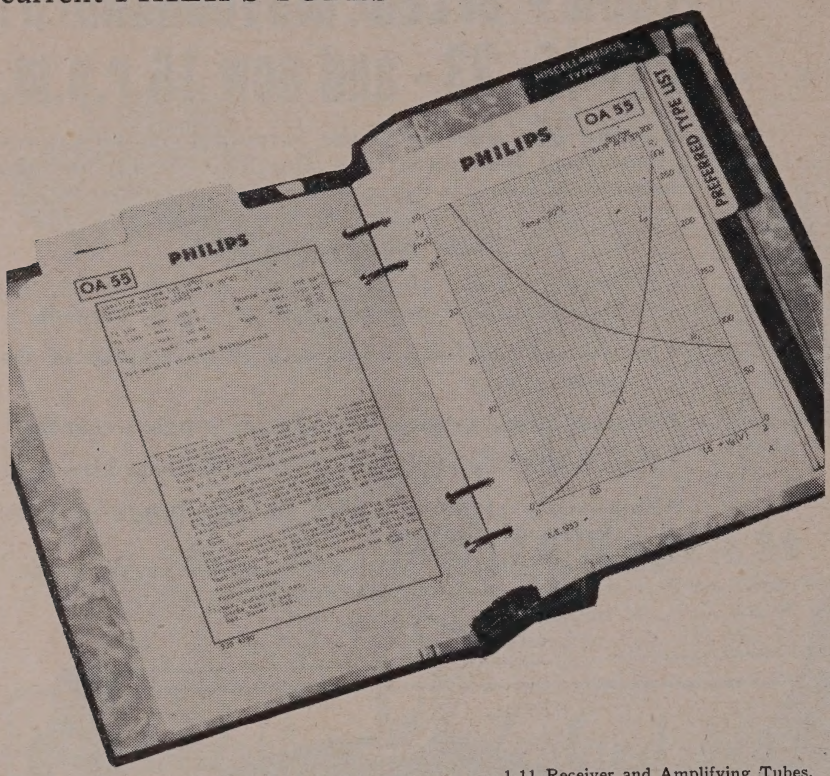

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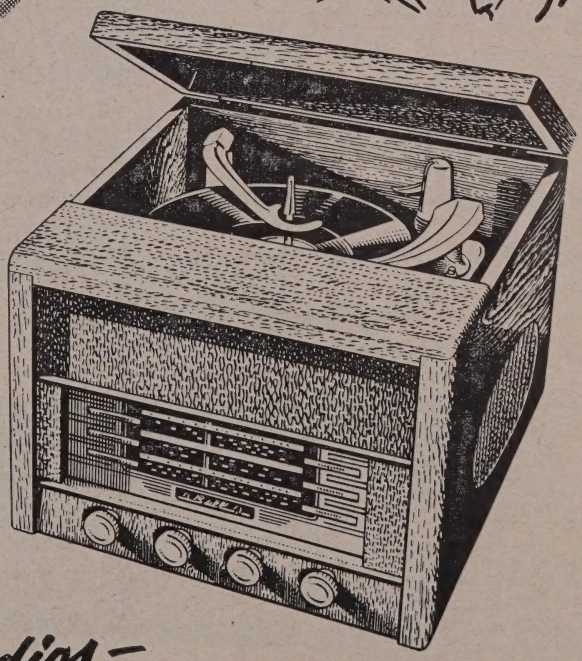

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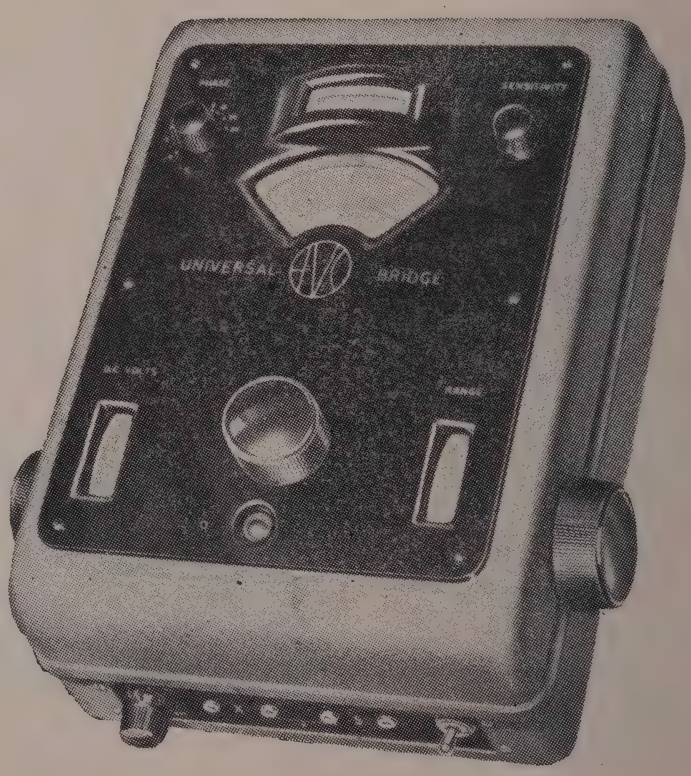

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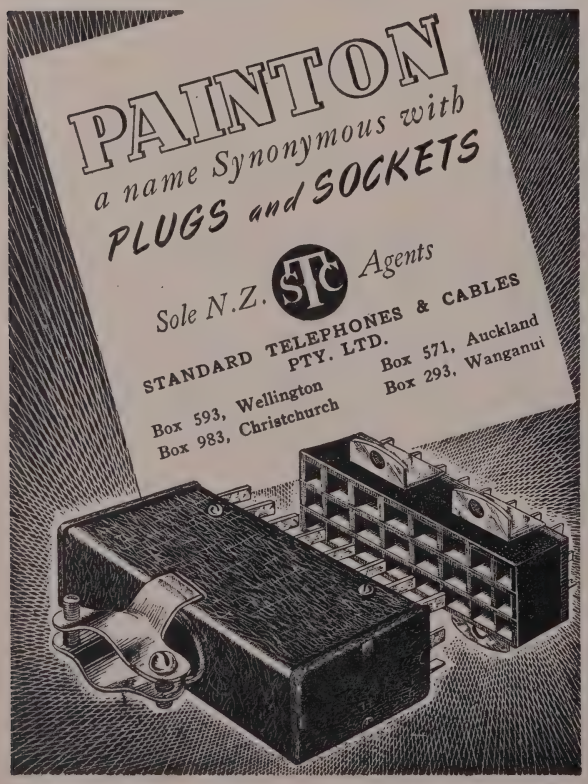

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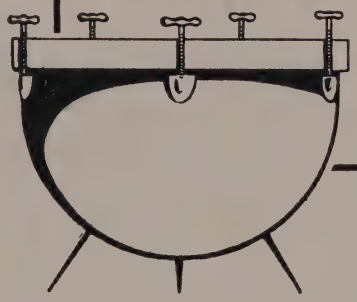

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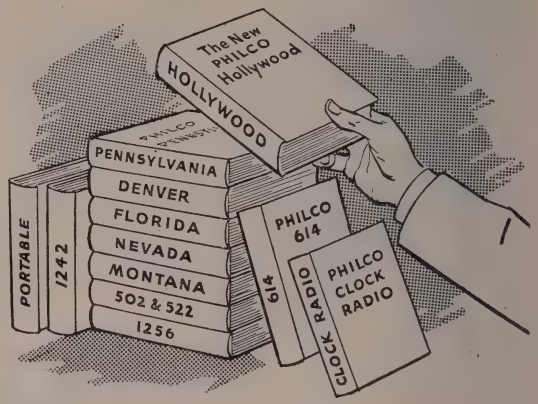

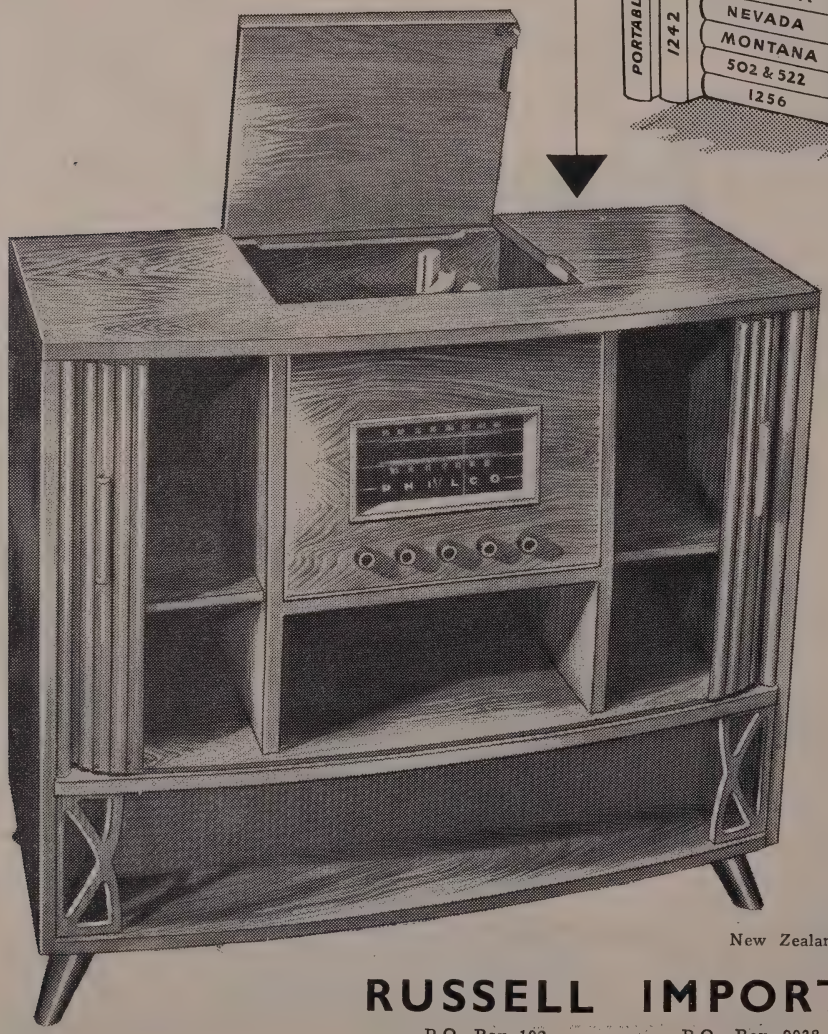

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G.E.C. instrument cathode ray tubes

The above illustration shows a typical supply network suitable for the E4205·B·7; the deflection sensitivity increases as Va3 is reduced until it is 0.28 mm/V at the minimum of 600V. G.E.C. electrostatic instrument tubes are available in four standard sizes. All have 4V heaters and short-persistence green screens. Brief details are given in the table—for further information apply to the Osram Valve and Electronics Department.

Type No.	Bulb dia. (mm)	V_{a3}	Sensitivity (mm/V)		Base
			X	Y	
E4103·B·4	39	600-1000	$\frac{90}{V_{a3}}$	$\frac{100}{V_{a3}}$	Brit. 9 Pin.
E4205·B·7	70	600-1500	$\frac{170}{V_{a3}}$	$\frac{170}{V_{a3}}$	B12B
E4412·B·9	90	600-4000	$\frac{350}{V_{a3}}$	$\frac{750}{V_{a3}}$	B12D
E4504·B·16	160	600-5000	$\frac{600}{V_{a3}}$	$\frac{1100}{V_{a3}}$	B12D

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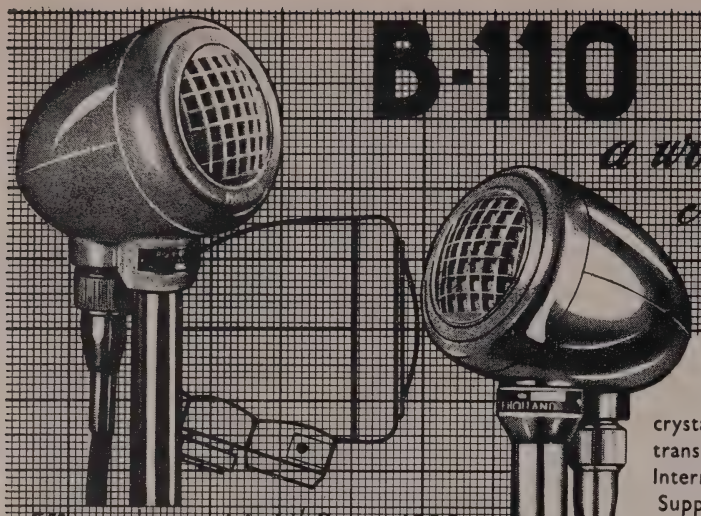

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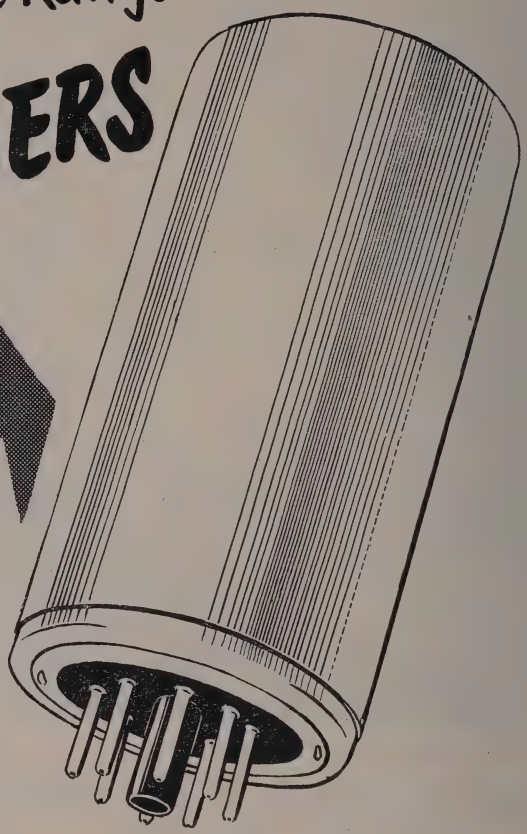

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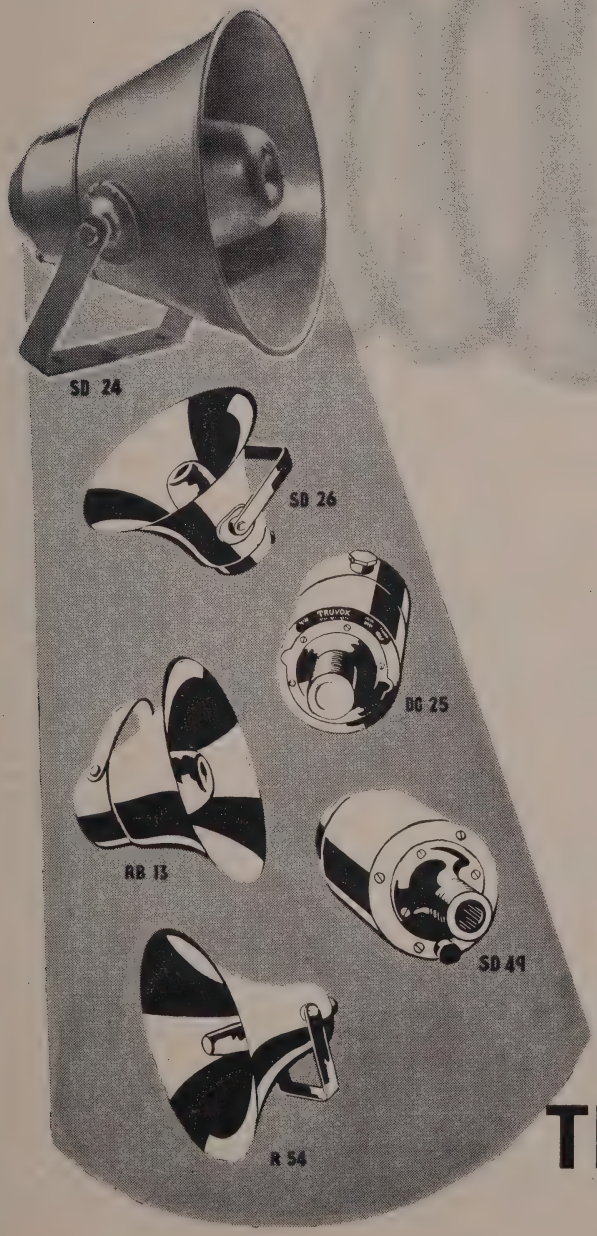

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Trends In Trading

At two recent conferences which this journal has attended, two matters have been discussed which are of considerable importance to both retailers and manufacturers alike. They are the questions of retail margins, and the channellling of goods through various outlets, other than what have been described as "legitimate" radio and electrical dealers. Each topic reflects a current trend in trading practice, at least in the radio industry, and in each case the views of retailers, and those of manufacturers or wholesalers, are to some extent conflicting.

The problem of the retail outlet is a somewhat vexed one. Retailers who have for years specialized in the sale and servicing of radio sets, and more recently of home electrical appliances, naturally tend to "take a poor view", to use the old Air Force expression, when they find their own speciality lines stocked by all and sundry, from furniture dealers to dairy companies. They have a good case, they think, for trying to persuade the manufacturer not to supply trading concerns other than legitimate radio and electrical dealers. On the other hand, the manufacturers say that under present-day conditions, they must sell their products through all possible outlets if their production and normal trading profit are to be kept up to respectable levels. Moreover, when asked to channel their goods only through a specific type of outlet, they naturally want to know whether their volume of sales will drop should they do this. Unfortunately, no proof, one way or the other, exists, but experience has shown that volumes of sales have increased whenever the number of retailing points has increased, and it is reasonable to suppose that the converse also will be true.

Radio dealers have in the past been used to selling under the franchise system, which gives a retailer the exclusive right to sell a particular brand in his own district, and all major manufacturers have used this system of appointing dealers. Now, however, it is apparent that the rigid franchise system is being replaced, all over the world by a more flexible one, whereby any dealer who wishes may stock a brand. The handling of what were at one time specialty lines by firms who are not specialists in that line is merely an extension of this principle, and is becoming more and more widespread.

We quite agree that it is unfortunate for the specialist dealer that things should be so, but on the other hand, there seems very little he can do about it, other than to encourage the public to buy from him rather than from firms which have no technical interest in the product. The radio and electrical dealer has a potent argument here, and it is worthy of note that the New Zealand Radio, Television, and Electrical Traders' Association, of Auckland, is taking active steps, through a comprehensive advertising campaign, to "sell" it to the public, at the same time as they are approaching manufacturers to see whether the latter will not consider supplying legitimate dealers only, and not chain stores, etc.

Some dealers appear to be very much exercised about the whole thing, even to the extent of advocating boycotts of manufacturers who refuse to co-operate, but fortunately, such militant spirits are in the minority. Any such action, as far as we can see, will do no more than push the business in exactly the wrong direction, for manufacturers must have an outlet for their goods, and any refusal on the part of individual dealers to handle certain brands can only force the makers concerned into the arms of the enemy, as it were.

As we see it, the difficulty we have been discussing is one that was bound to occur sooner or later. In the early days of radio, reliability was so much less than it is now, that no one without servicing facilities would have dared to handle sets in quantity. Now, however, the reliability of radio sets is such that with very little trouble to the public, they *can* be sold over the counter. In other words, radio has simply graduated from the status of a scientific novelty to that of a fully engineered product which gives so little trouble in use that the public no longer insist on buying from a technical specialist. This is not to say that the public would not be far better off if it confined its purchases to those retailers who have a background of technical knowledge. We think it would be, but as we have said earlier, we are afraid that the radio dealer will have to convince the public that this is so, and will have to chase the business which tends to divert itself into other channels.

Tape Recording

USING the "R. & E. TAPE RECORDING AMPLIFIER" WITH A "COLLARO" TAPE DECK

Readers will remember that the circuits described in recent issues of this magazine were built to suit the Truvox tape deck. Recently, however, an excellent deck by Collaro has become available; in response to many inquiries we are printing the following article, showing the modifications needed to enable the original circuits to be used with the Collaro deck.

INTRODUCTION

Now that several tape decks, of good performance, have become available interest in tape recording and reproducing circuits has heightened considerably, and we have had an overwhelming response to the series of articles describing the "R. & E. TAPE RECORDING AMPLIFIER". This series was written round some excellent circuits, which are directly applicable to many decks and head types, and in particular to any deck, like the Truvox, which has high-impedance record/playback and erase heads. Some decks, however, do not have heads similar to those used by the Truvox, so that the original circuits need some slight modification before they can be applied to these decks. One which has recently appeared on the New Zealand market, and which looks as if it will become extremely popular, is the Collaro. It is provided with four heads—two erase and two record/playback—in order that dual-track tapes may be used without having to lift the reels and transfer them to the opposite spindles. In addition, there are provided four push-button switches which each comprise several separate change-over wafers. These switches are intended to be used to change the amplifier circuit from record to playback, depending on which button is pressed, and to ensure that the correct pair of heads is connected, depending on which track is in use. The push-buttons simultaneously actuate the stopping, starting, and braking functions inside the deck itself, so that when the switches are appropriately wired up to the amplifier circuits, only one push-button has to be operated to select any particular function. With simpler decks, like the Truvox and the Brenell, the switches on the deck control only the deck functions, which means that the selection of the proper amplifier function must be done by means of a separate switch on the amplifier chassis. Also, in order to change tracks on any machine which has only one set of heads, it is necessary to take off the reels, turn them over, and replace them on the opposite spindles from the ones they were previously on. Many people will not object to this, particularly as the amplifier switching is somewhat less complicated, but if the maximum operating convenience is wanted, then a four-head machine like the Collaro is the one to have, even though setting it up will be more complicated, and will take longer to accomplish.

DIFFERENT HEADS

It will be remembered that the "R. & E." circuits were designed on the assumption that both the erase and record/playback heads were of the high-impedance variety. In the Collaro deck, however, the

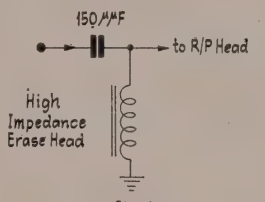


Fig. 1

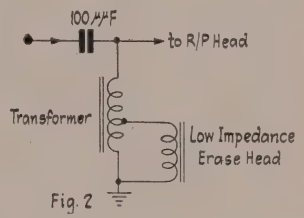


Fig. 2

erase head is a low-impedance one, and so cannot be fed directly from the plate of the H.F. amplifier, as was the high-impedance head in the other deck. Thus, using the Collaro deck entails modifications of two sorts. First, the head circuit must be modified to take care of the low-impedance erase head, and secondly, the switching shown in our original circuits is disregarded, and an entirely new switching diagram is wired up, showing how the push-button switches on the Collaro deck are to be used.

The head modification is quite simple and straightforward. In Fig. 1 we have drawn the erase head portion of our original circuit, and in Fig. 2 is shown the new head circuit for the Collaro. It will be seen that the only modification in principle is that the high-impedance erase head is replaced by an auto-transformer, the small winding of which feeds the low-impedance erase head. In Fig. 1, the erase head itself is tuned to series resonance with a 150 μμfd. condenser, but in Fig. 2, it is the whole winding of the auto-transformer that is so tuned, and this time the required capacity is only 100 μμfd.

In the Collaro deck, the record/playback head is of somewhat lower impedance than that in the other deck, but it can be used with the original record and playback circuits without any basic modification at all. There is only one change in detail, and that concerns the capacity that is connected across the head to tune it, in order to produce some lift at the extreme high end of the audio range. In the original circuit, the R/P switch was arranged so that it was tuned to somewhat different frequencies on record and playback, but with this head, the most satisfactory arrangement was found to be to tune it to the same frequency all the time.

THE MAIN SWITCHING DIAGRAM

When the "R. & E" circuits are used, the complete switching set-up is as shown in Fig. 3. At the top of the diagram we have represented the four push-buttons, and immediately below each is found a

number of change-over sections, each represented by three contacts and a sliding conductor. In every case, the middle contact makes to the sliding piece at all times, so that when the button is pressed, the lower contact is connected to the centre one. When the button is up, the centre contact is connected to the top one.

In the diagram, all buttons are shown in the upper, or OFF position. Also, the buttons are so arranged mechanically, that it is not possible to have more than one of them depressed at a time. This description should be sufficient to enable readers to follow the manner in which the switching is effected. It should be mentioned, however, that we have drawn only those switch sections that are used. Each button actually has eight of these change-over switches, all of which operate whenever it is pressed. Thus, there are many more switches provided than are needed by our circuit, and many of them are entirely unused. Some circuits, however, will need most, or even all of them. The reason for the relatively small amount of switching involved here is to be found in the fact that we have provided entirely separate circuits for the playback amplifier, record amplifier and H.F. generator portions. In general, circuits in which several valves play different roles on playback and recording will need more switches, and the Collaro deck has provided against such contingencies.

On the switching diagram, we have included the erase head's transformer, and the other components associated with the heads. This has been done because the best place for these parts is at the deck itself. Accordingly, they have been mounted on a small paxolin panel in our prototype installation, and this panel has been screwed to the main casting of the deck.

A further point to note is that we have drawn only four of the six push-buttons, the remaining two being the "rewind" buttons. This is because the rewind buttons have no connection at all with the circuits, since they act on the motors, capstans, etc., only. Moreover there are no switches attached to these buttons. Similarly there is no need to show the "off" button, because all this does is to release mechanically any of the buttons that is in operation, automatically returning it to the position in which all of them have been drawn.

TRACING THE SWITCHING

In order to see what the switches do, it is necessary only to look at half the diagram, as it is symmetrical about a centre line. First of all the top switch of the P_1 button has its common lug connected through shielded wire to the input of the playback amplifier. When neither P button is pressed, the playback amplifier input is earthed through two pairs of contacts; these pairs are in series, one on each P button, so that the earth connection is removed if either P button is pressed. Two lengths of shielded wire are used for the earthing connections, because if this were not done, there would be a length of open wire connected to the "hot" end of the head while it was being used for playback, and this would result in serious hum pick-up.

When the P_1 button is pressed, the top switch (a) breaks the earth connection to the input of the playback amplifier and (b) connects the left-hand R/P head to the amplifier input.

The second switch operated by P_1 earths the blue lead from the left-hand R/P head.

The bottom switch on P_1 connects the H.T. to the playback amplifier when the button is pressed, and disconnects it when the button is in the up position.

Now let us trace the switching operated by one of the record buttons, R_1. The upper switch connects the red lead from R/P_1 to the Record Amplifier when R_1 is pressed. The next switch down connects the blue lead from R/P_1 to the H.F. bias circuit. The third switch connects the E_1 head to the tap on T_1, ensuring that the erase head for the operating track is in operation. The fourth, or bottom switch connects the H.T. to the H.F. oscillator when pressed, and disconnects it when released by the stop bar.

On the other track, which is brought into operation by R_2 for record, and P_2 for playback, the switching operations are identical, except that the other pair of heads is brought into use.

MODIFICATION TO THE AMPLIFIER

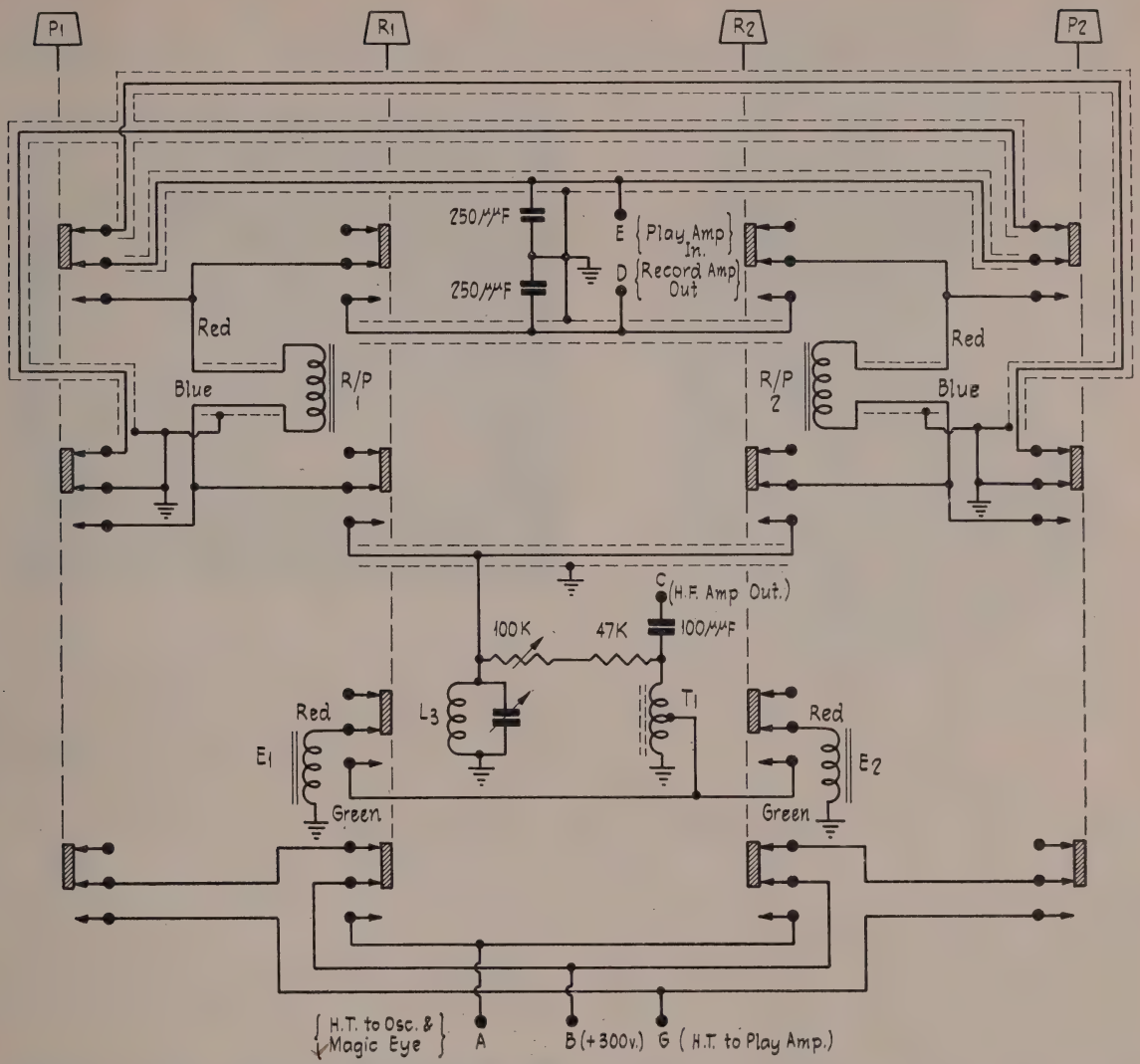
On Fig. 3, the points which go to the amplifier circuits have been labelled both with their respective functions, and also with letters. These refer to the appropriate points on the amplifier circuits, in the previous series of articles, but it is obvious that provided separate amplifiers are available, the switching diagram will be the same irrespective of the exact amplifier circuits. Figure 3 is thus directly applicable to any arrangement in which the circuits for playback, recording, and for producing the H.F. erase power are separate from each other. Where some tubes are common to two of the different functions, as for example, when there is a power pentode acting as a speaker amplifier on playback, and as an H.F. oscillator on Record, the user will have to work out his own switching arrangement, but this should present little difficulty, because the circuit used will always show the necessary change-over switches, and these can be "translated", as it were, to those on the deck.

SETTING UP OF THE COLLARO

The setting up of the circuits for the Collaro deck will be exactly the same job as setting them up for the Truvox, except the voltage across the erase head, and the optimum bias voltage to be applied to the R/P head on Record will both be different. In the leaflet supplied with the Collaro deck, recommendations for these H.F. voltages are given, but with the sample used by us, the optimum values were slightly, though not widely different from those recommendations. This may be due to the fact that we were adjusting for best results with a particular tape, namely BASF, while the Collaro recommendations do not mention any particular make, and give a range of values. In our own case, the voltage across the erase head was adjusted to 17.5v. R.M.S., or 25v. peak, while the voltage of H.F. bias at the blue lead of the R/P head was adjusted to 91v. R.M.S., or 130v. peak.

THE ERASE HEAD TRANSFORMER T_1

This is wound on a Ferroxcube pot core, type D25/16/3B3. It consists of a single winding of 271 turns, tapped at 21 turns from the earthed end. Thirty-four gauge enamelled wire was used, and under working conditions, the Q of the tuned circuit was found to be 3. This is higher than the Q of the



Complete circuit of the deck switching, and all heads, for using the R. & E. circuits with the Collaro deck. T_1 is specified in the text, and all other components are as specified in the original series of articles. Note however, the addition of the 47k. fixed resistor in series with the 100k. variable.

IMPORTANT CORRECTIONS

We must regretfully draw readers' attention to two errors which occurred in the circuit diagram of the record amplifier, on page 19 of the September, 1956, issue.

(1) Two 68-ohm resistors are shown in the cathode circuit of the first ECC83. **The lower of these should read 680 ohms.**

(2) In the lead shown going from the plate of the first section of the first ECC83 to the grid of the first section of the second ECC83, **there should be a blocking condenser of 0.05 μfd.**

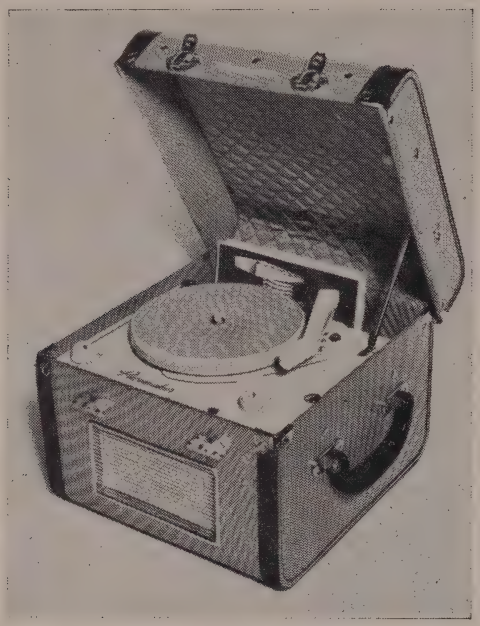
high-impedance erase head in the Truvox deck, and makes the required erase current easier to obtain from the H.F. amplifier, which runs considerably lighter, and probably with better waveform.

It will be seen that the 100k. adjustable resistor that is used to set the bias voltage with has been supplemented in this instance by the use of a 47k fixed resistor in series with it. This is because of the higher Q of the T_1 circuit, which results in a larger voltage appearing across L_3. The extra resistance is needed in order to cut down the bias voltage to the required value. In addition, the bias voltage re-

(Concluded on page 49)

New Developments

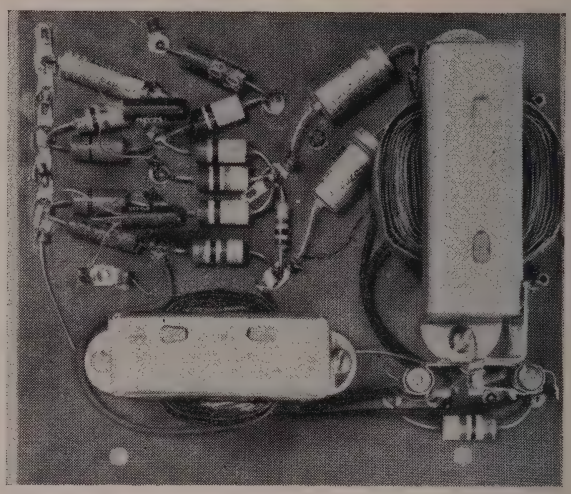
A TRANSISTORIZED BATTERY-OPERATED ELECTRIC GRAMOPHONE



INTRODUCTION

Up to the present time, the only transistorized equipment to be in every-day use by the public is the hearing-aid amplifier. In this field, transistors have virtually ousted the sub-miniature valve, and they have done so without any great flourish of trumpets. Ask the user of a hearing-aid, though, who has had experience of both valve and transistor types, and you will soon find which he likes best! To the technically minded, it may seem strange that transistors have not made further inroads into domestic equipment, but very little thought is needed to make one realize that there really are not very many applications for present-day transistors in domestic equipment.

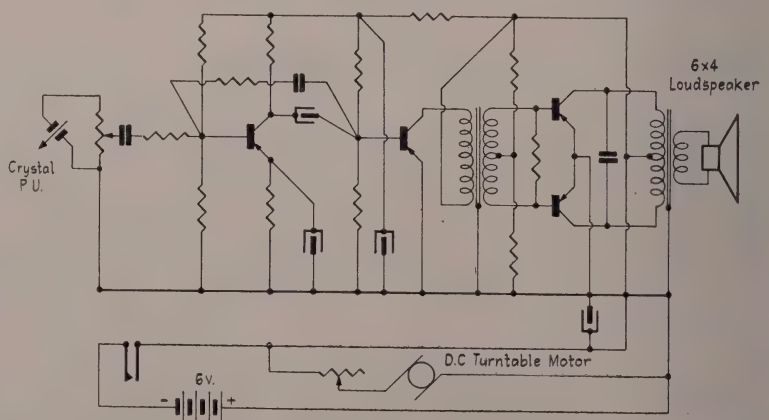
The day will surely come when all portable radio sets are completely transistorized, but this country has yet to see its first set of this kind on general sale. There are very good reasons for this which have to do both with costs, and with the availability of really suitable types of transistor for R.F. applications, and we think that manufacturers are wise to hasten slowly on this one. However, the honour of placing on the New Zealand market the first transistorized domestic equipment other than a hearing aid, goes to Messrs Collier and Beale Ltd., who have always been in the forefront of this country's electronic development.



A TRANSISTORIZED GRAMOPHONE

Over the years, the acoustic portable gramophone has been an exceedingly popular instrument, in spite of its obvious limitations. These days, the acoustic portable is even more severely limited, in that it can play only one type of modern record, namely the 78 r.p.m. shellac disc. whose popularity seems to be waning, even for "popular" recordings, in favour of the smaller and lighter 7 in. discs playing at 45 r.p.m. Consequently, there should be a great demand for a portable gramophone which will play these records. This has been made possible by the advent of transistors, and by the development of gramophone motors which operate at very low currents from a 6-volt dry battery.

This, then, is the story of the present instrument. It uses only a 6-volt lantern battery to power both the transistor amplifier and the gramophone motor.



The total current drawn from the battery is in the region of 70 ma. at low output levels, rising some-

what under maximum signal conditions. This is because the output stage is a Class B one, in which the current drawn from the supply varies with the signal level, just as in a valve Class B stage. Under average conditions of use, the lantern battery can be expected to give some 400 hours of operation. One advantage of transistors is that they come on instantaneously, so that it is possible to turn the whole gramophone, including the amplifier, on and off with a single switch. This is located in the pick-up arm assembly, so that when it is moved into the playing position, both the motor and the amplifier are automatically turned on. Conversely, they are turned off when the arm is returned to the rest position.

PERFOMANCE OF THE UNIT

This journal had the opportunity of hearing the prototype equipment in operation a few days ago, and we were most favourably impressed with its performance. A 6 in. x 4 in. elliptical speaker is incorporated, and with the 300 milliwatts available from the output stage, it gives a sound output of astonishing power and quality. Naturally, no claims are made for high-fidelity results, but our own immediate impression was that for volume, and general quality, the transistor circuit left far behind all the battery portable radio receivers we have heard, bar none. It would not surprise us if the layman, after experiencing the advantages of this machine, does not ask how soon he can have transistor portable radio receivers!

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N.Z.A.R.T. NOTES

THE LATE JACK McKIM, ZL3LL

It is with deep regret that the N.Z.A.R.T. records the death of Jack McKim, ZL3LL, who passed away at Christchurch on Friday, 28th September, after a short illness. As Publicity Officer of the Association, Jack was responsible for the notes which have appeared in this column for nearly two years. A young man in his 35th year, he devoted his time and energy to the interests of the N.Z.A.R.T., serving in different ways the Radio Amateurs of this country.

Jack was first licensed at Timaru, and while there took a live interest in the affairs of that Branch of the Association. Following his transfer to Christchurch, he immediately became active in the Branch there, and served for two years as Chairman. For over three years he was editor of the Association's journal "Break-In", until the transfer of the editorial responsibility to Dunedin. Upon its return to Christchurch, Jack became its advertising manager, occupying this position until his death. He was a member of the Executive Council last year, and the Publicity Officer of the Association for a number of years.

Notwithstanding all this activity, Jack found time to devote to his hobby of Ham Radio. He was a keen experimenter, enjoying nothing so much as trying out something new. The DX bands also had their appeal, and there stood to his credit a long list of "countries worked". As an entrant in many of the Association's contests, he was successful on more than one occasion in the CW sections. As a Ham, however, he will long be remembered for his interest in his fellow amateurs, and the willing assistance he was always so ready to give.

In the passing of Jack McKim, the Association has lost a great worker.

He joins the ranks of "Silent Keys", but we shall never forget his contribution to the N.Z.A.R.T. To his wife, son, and mother we extend our deep and sincere sympathy.

HARRY F. ARNOLD,
President, N.Z.A.R.T.

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HOW SINGLE SIDEBAND SIGNALS ARE MADE

In this section of "R. & E. R." we have already discussed the pros and cons of S.S.B. transmission and reception. This month's article describes some methods of generating S.S.B. signals, and discusses their relative merits.

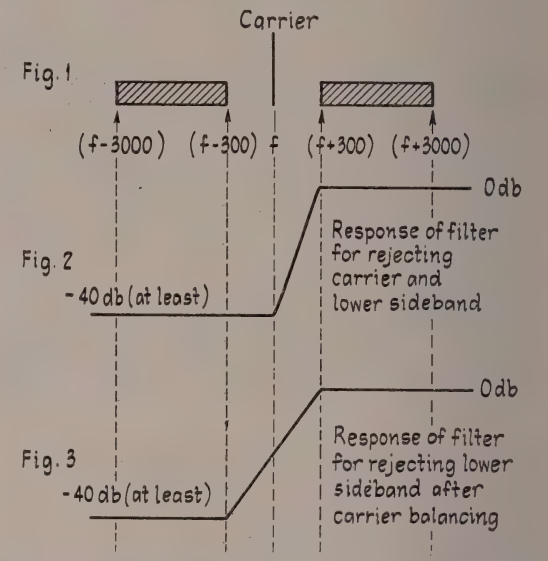
INTRODUCTION

After the last two articles on the application and advantages of single - sideband - suppressed - carrier transmission, it is not proposed to spend any more time on these aspects, but to examine some of the methods that are in current amateur use for actually generating S.S.B. signals. Unfortunately, a great variety of methods does not exist, and none of the ones that do is quite as simple and straightforward as ordinary amplitude modulation. However, nothing worth-while is achieved without a little effort, and the ways of making the sort of signal we are after are not at all difficult to grasp in principle. If they appear complex, then, it is because of a multiplicity of separate operations, and not because there is anything inherently complex in the method itself.

THE "BRUTE FORCE" METHOD

It appears to be one of the awkward laws of nature that in any modulator that can be devised, two sidebands are always generated. This being the case, there is only one way, fundamentally, to generate a single sideband. It is to make a modulated carrier first, and then to remove one sideband and the carrier, leaving only the other sideband. Without exception, all methods amount to this, the differences between them being found only in the methods used for removing the carrier and the unwanted sideband.

In principle, the simplest way of doing this is what we have called the "brute force" method, which consists basically in passing the modulated signal through a filter which has a very sharp cut-off at the desired frequency. Let us look at some figures, to see what this method involves. Suppose, first of all, that our modulation, which is speech, will occupy the band extending from 300 to 3000 c/sec. The modulated signal will then look something like Fig. 1, which shows a carrier, of fixed amplitude and frequency, with sidebands on either side of it, extending from 300 to 3000 c/sec. away from the carrier frequency. The sidebands will vary in amplitude and frequency content according as the modulation changes, but it is possible for any or all frequencies in the range to be present simultaneously. Notice that the frequency scale on Fig. 1 is very much extended, and would represent only a bit more than a pointer's width on any ordinary high-frequency receiver. If we are to remove both the carrier and one sideband by means of a filter, the latter will need a frequency response similar to the one shown in Fig. 2, directly underneath Fig. 1, and drawn to the same frequency scale. We can say that a reasonable degree of rejection of the unwanted parts of the signal is 40 db., so that examination of Fig. 2 will show the kind of cut-off characteristic required from the filter. The attenuation at the edge of the wanted sideband, and throughout its frequency range, should be as small as possible, ideally zero. The attenuation at the carrier frequency should be at least 40 db., and should be no less than this over the whole range of the **unwanted** sideband. From this we can see



that we need a drop in response of at least 40 db., within a frequency range of 300 c/sec. But since the carrier is at the desired radio frequency of our transmission, this 300 c/sec. is a very small fraction of the carrier frequency, so that for this filter scheme to work, we need a filter with an almost incredibly steep-sided cut-off. If the filter is to be built using ordinary coils and condensers, such a sharp cut-off is impossible to achieve at any amateur frequency, so at first sight, it looks as if the scheme is impracticable. Although we have not yet said so in so many words, the real reason for this is that any coils we can make have Qs that are much too low. Now it is well known that quartz crystals have very much higher Q values than any wound coil, but even so their Qs are hardly great enough to make this simple system workable at high radio frequencies. If we bring the frequency down to the region of 400 to 500 kc/sec., it is possible to get the required degree of selectivity from cystal filters, but then only if four to eight crystals are used.

The purpose of this discussion is not really to show that the job of generating an S.S.B. signal is well-nigh impossible, but only to show that it is difficult to perform in a single filtering operation because of the incredibly sharp cut-offs that are needed.

A TRICK THAT HELPS

Another point about the story so far is that unless it is understood why the simple and obvious method of removing the unwanted components is difficult or even impossible, it is difficult to see why the relatively complex arrangements that are used, should be needed at all. What we want is clearly some

method of filtering that allows us to use practicable filters, that **can** be built. Anything, therefore, which enables us to use filters with less sharp cut-offs, is a step in the right direction, and a very important trick in this respect is the use of the **balanced modulator.**

This is a device that figures very largely in S.S.B. stories, but its usefulness is not always made clear. Let us look once more at Fig. 2, and then at Fig. 3, which once more is drawn to the same frequency scale. If it were possible to remove the carrier by some means distinct and separate from the filter, then our requirement for 40 db. attenuation at the carrier frequency would no longer hold. It would be possible to use a filter whose attenuation reached 40 db. at the inner edge of the unwanted sideband; this has been illustrated in Fig. 3, which shows that with the carrier removed **before** using the filter, the attenuation slope need be only half as steep as was needed in Fig. 2, where the filter was responsible for removing the carrier as well as the unwanted sideband.

The device which enables the Fig. 3 trick to be done is the **balanced modulator.** This can take very many forms, from simple diode circuits, to arrangements that look like push-pull amplifiers, but they all have this much in common—they generate the two sidebands **without the carrier.** The mechanism of their action is similar in many respects to that of a push-pull amplifier, which has the property of balancing out second harmonic components that are generated in the individual valves. In the balanced modulator, each valve passes carrier frequency as well as the sidebands, but the circuit is so arranged that the carrier components from each side of the circuit balance out in the output circuit, in which the sidebands add together, and appear in the output circuit. A well-constructed balanced modulator can give an output in which the carrier amplitude remaining (because balancing is seldom perfect) is 30 to 40 db. lower than it would be in an ordinary modulator circuit.

However, even with carrier balancing, it is impracticable to use direct filtering to remove the unwanted sideband, unless the carrier frequency is quite low —say, 500 kc/sec. or lower, so that our problem is still unsolved, because in general we are interested in transmission frequencies much higher than this.

HOW IS IT DONE?

So far, we have found a method of generating a single sideband at a frequency of, say 450 kc/sec., and that is all. It comprises two steps: (a) a 450 kc/sec. carrier is modulated in a balanced modulator, which gives as its output two sidebands, but no carrier. (b) The balanced modulator output is passed through a highly selective filter, which can be built only by using several crystals, but which by brute force removes one sideband and allows the other to pass on. Unfortunately, however, we do not want to transmit on 450 kc/sec., and even if we did we would not be allowed to, so we must think of another scheme.

Suppose we take our single sideband, at its convenient frequency of 450 kc/sec., and feed it to a second modulator, or, to give it another and more familiar name, a frequency changer. Also to this frequency changer we feed a C.W. signal from an oscillator working at 3250 kc/sec. As with all frequency changers, the two inputs will beat together to produce new frequencies, which are the sum and difference of the original ones. Each frequency component of the S.S.B. signal on 450 kc/sec. will beat with the CW oscillator to produce **two** new frequencies, so that once more we will have **two** sidebands produced. This might look as if we were back where we started, and so we are—almost. It is this "almost" that really counts, as we shall see in a moment.

To make the job simpler, let us assume that our original modulation is a test tone of 1000 c/sec., remembering all the time that with speech modulation, it could be any or all frequencies between 300 and 3000 c/sec. In the first modulation process, the "sidebands" representing the test tone will also be single tones, at frequencies of 449 and 451 kc/sec. respectively. The filter is built so that it removes the lower sideband, and the carrier is absent from the output of the balanced modulator to start with, so that our single-sideband signal is a tone, or single frequency, at 451 mc/sec.

We now apply this, together with a new carrier at 3250 kc/sec., to our frequency changer, or second modulator. If this, too, is of the balanced type, no carrier will appear in the output, but the sidebands will, and these will be (3250 + 451) kc/sec. and (3250 — 451) kc/sec. respectively, or 3801 kc/sec and 2799 kc/sec. This time, the sidebands are 902 kc/sec. apart, and so can be separated from each other by a simple tuned circuit in the output of the modulator. We then finish up with a single frequency of 3801 kc/sec. To receive this, a carrier can be re-inserted at 3800 kc/sec., and the combined signal passed to a detector, the output of which will be the original 1000 c/sec. tone.

Thus, the double modulation-cum-filtering process has given us a single sideband on a (supressed) carrier frequency of 3800 kc/sec., in the 80 m. band.

STATEMENT OF THE PRINCIPLE

This, then is the principle of the "brute force" method:

(1) A single sideband is generated at a frequency low enough to enable a filter to separate it from its unwanted twin.

(2) A second modulation process then produces two new sidebands which are spaced in frequency by twice the frequency of the original carrier.

(3) This spacing is great enough to enable a single tuned circuit to separate the wanted from the unwanted sideband.

TRIPLE MODULATION

Reading back, it will be noted that we have assumed the use of an initial carrier frequency of 450 kc/sec., and a complex and costly crystal filter. The question then arises as to how we get on if suitable crystals are not available, or if they cannot be afforded. The answer might by this time be self-evident, in that the purpose of an initial low-frequency carrier should by now be clear. Fundamentally, the choice of a low initial carrier frequency is to enable a practical filter, with a finite attenuation slope, to do the job of sideband separation. Logically, then, if a much lower carrier frequency had been chosen initially, it would not have been necessary to use a crystal filter circuit for this job.

(Concluded on page 30)

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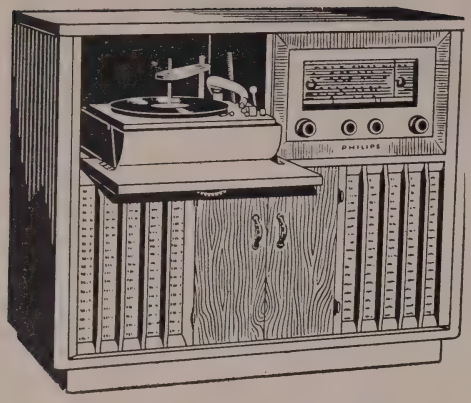

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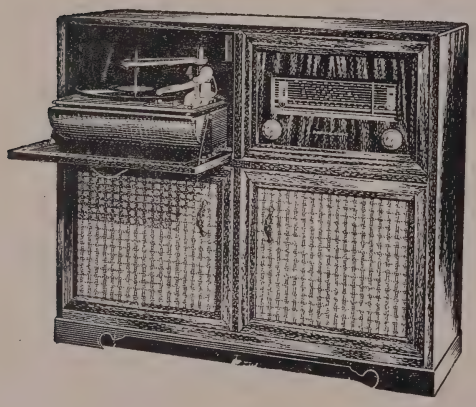

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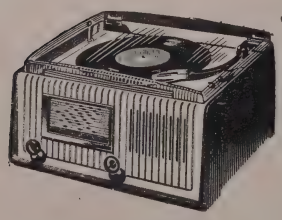

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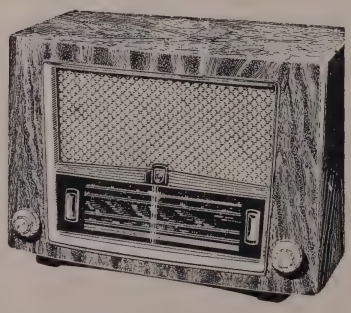

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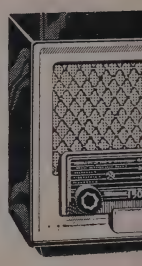

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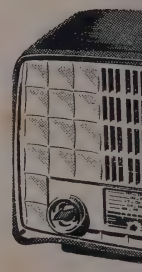

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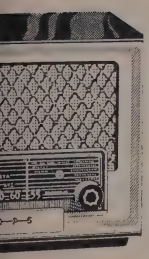

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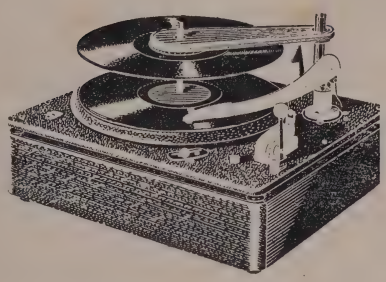

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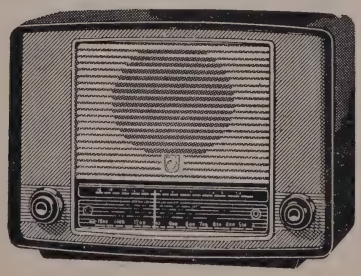

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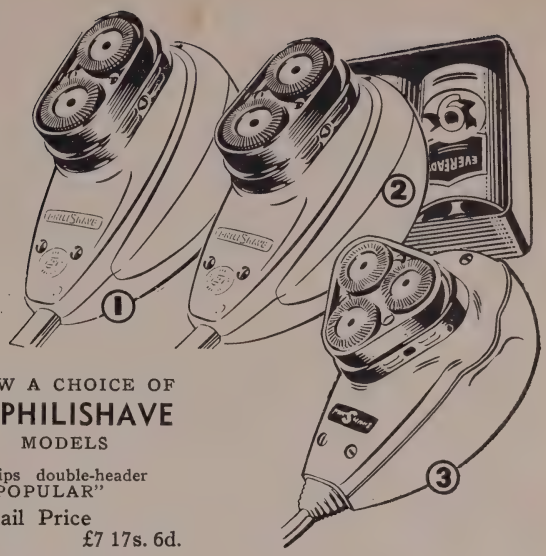

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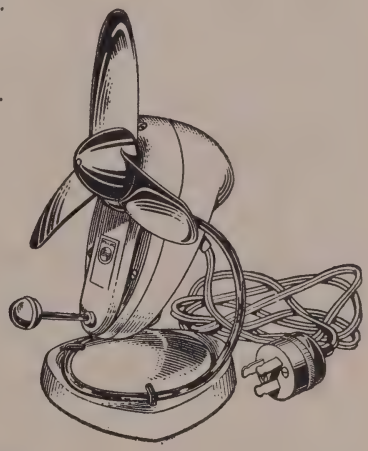

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(Continued from page 27)

Suppose, for example, that we use a very low initial carrier frequency, as for example, 20 kc/sec. With modulation frequencies extending down to 300 c/sec., and with balanced modulation, the filter would then need to have a response dropping from zero attenuation at 20,300 to 40 db. at 19,700 c/sec. The required drop has still to be accomplished in the same number of cycles, but from the point of view of the filter circuit, the important thing is the ratio between the width of the band over which the drop must be achieved, and the frequency at which the filter is to work. Thus, the lower the frequency the more favourable the conditions, and if the filter is to work at 20 kc/sec., it is no longer necessary to use crystals. Ordinary tuned circuits, when properly designed as a filter, will do the trick.

It is for this reason that many S.S.B. transmitters use three modulations. The first is often at about 20 kc/sec., the second at about 450 kc/sec., and the final one in the 80 m. band. This is what may be described as the "full treatment" according to the filter method, which is the polite term for the "brute force" one.

THE PHASING METHOD

The main disadvantage of the filter method is that it cannot be carried out directly at the final carrier frequency. This disadvantage is completely avoided by what has become known as the phasing method of generating S.S.B. signals. Briefly, this consists in using two balanced modulators, whose outputs are combined in a common output circuit. Each modulator turns out a carrierless double-sideband signal, but matters are so arranged that the upper sideband from one modulator cancels out the upper sideband from the other modulator, while the two lower sidebands add up instead of cancelling.

In order to do this, two things must be done:

(1) There must be a phase difference of 90° between the carrier voltages fed to the two modulators.

(2) There must similarly be a phase difference of 90° between the audio voltages fed to the two modulators.

Of course, other requirements must be met at the same time, but the above are the main ones. For many years, this scheme was impracticable, because no method was known whereby a complex audio signal could be shifted in phase by the same amount at all frequencies inside its band. For single tones, the job is easy, but networks giving equal phase shift at all frequencies from 300 to 3000 c/sec. were developed only since the last war. The phase shift networks are tricky to make, because their components must be held to quite close tolerances if the networks are to function properly, but it can be done, and the phasing method, properly carried out, is probably the least expensive method of doing the job. It does have the disadvantage of critical adjustment, and that unwanted sideband rejection can be very poor if the circuits are maladjusted, but even so it has been the means of allowing many amateurs to have a go at S.S.B. who would otherwise have "given it away", as the saying goes.

COMPARISON BETWEEN METHODS

The main disadvantages of the phasing method have already been indicated. The main disadvantage of the filter method is its cost. The first two filters, especially the 20 kc/sec. one, has to be quite complex if it is to work properly, and several high-quality inductors are essential for this part of the circuit. The advantage is that once designed and built, there is very little that can or will go wrong with it. It is never wasted, because whatever frequency one wants to use, the first two modulators and filters are always in operation. Also, remembering the advantages of S.S.B. in cutting out costly high-powered modulators, and that all the tricks associated with S.S.B. are done at receiving-tube power level, it is quite feasible to put up with the expense of the filter method, which is still not great in comparison with a medium-powered A.M. transmitter.

In next month's article, we will say something about how power is obtained at R.F., after the low-powered S.S.B. signal has been made at the operating frequency.

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Measurements

An Audio Frequency Intermodulation Meter

In last month's issue of this journal there appeared an introductory article on the measurement of intermodulation distortion. This article describes the design and circuits of a complete intermodulation meter that we propose to use for obtaining figures on the high-quality audio equipment that is featured in these pages from time to time.

INTRODUCTION

Readers may sometimes have wondered whether the "Radio and Electrical Review" laboratory counts among its facilities equipment for measuring distortion, and whether the designs we have published for high-quality audio equipment have been subjected to rigid distortion tests before being "let loose", as it were, on an unsuspecting public. This appears to be the appropriate place to make the confession that until very recently, we have not possessed distortion measuring equipment as such, and that hitherto, our estimates of distortion have been based on listening tests, combined with indirect methods. In view of the fact that many of our designs have enjoyed considerable success among technical and non-technical people alike, it might be wondered how it has been possible to turn out amplifier designs which give excellent results, without being able to take measurements of either harmonic or intermodulation distortion, and it is here that we are able to let readers into the secret!

The fact is that since negative feedback became an integral part of the design of all high-quality amplifiers, it has been possible almost to guarantee very low percentages of distortion, merely by measuring the degree of negative feedback used on a given amplifier, by using the oscilloscope to judge when individual stages are giving their best results, and by performing fairly extensive listening tests. Now such methods do work, in the hands of anyone who knows what most of the pitfalls are, and where they are to be expected, and to some degree at least, they are to be preferred to the opposite extreme, which consists in using built-up measuring devices such as wave analysers and distortion meters exclusively, and in relying implicitly on their evidence without recourse to the "unscientific" method of listening, at all. Undoubtedly, the best method of evaluating the performance of audio equipment is by a combination of both methods, with listening tests as perhaps the final arbiter.

We have no doubt that many people who spend either their working or leisure hours (or both) in dealing with audio equipment would be very keen to have available some means of measuring distortion, even though almost everyone will make his own ears the ultimate judge, but wanting and having such equipment are two very different things. For most purposes, the expense of commercially available distortion measuring equipment is prohibitive, so that only extremely well set up and relatively wealthy laboratories are able to justify it. For example, in a broadcasting station, distortion measuring equipment is an absolute essential, because distortion must always, if at all possible, be traced and eliminated before it has reached the stage where the listener with the best equipment can hear it for himself, and the only way that this can be done is to use instruments, together with an intimate knowledge of the equipment itself. For example ,one make of intermodulation meter by a very famous firm, has become a virtual standard for such measurements, in that engineers in America and elsewhere have come to regard it as an instrument whose results can always be compared with confidence, irrespective of what part of the world it is used in. Thus, if one of these meters is used in obtaining results which are then published in the technical press of the world, anyone else who has the same equipment knows with reasonable assurance that his own measurements may validly be compared with someone else's. Unfortunately, the gear in question costs roughly £500, so that the fortunate individuals able to use it, are relatively few compared with those who would like to be able to.

Fortunately, however, it is possible to build distortion measuring equipment of this sort, given the need and the time. Even to build, however, it is not inexpensive, and the design difficulties are fairly considerable, so that unless one has a real requirement for it, these things in themselves are enough to deter all but the most stout-hearted.

WHY DESCRIBE IT HERE?

At this point, it may be asked why we are taking up valuable space by discussing the matter in detail, and in giving a fairly comprehensive description of the equipment that has been built for our own laboratory. It is a fair question, and deserves a fair answer.

We realize that not very many of our readers will want to go to the trouble and expense of duplicating the equipment that is about to be described, but we do hope that all readers who are interested in audio equipment will read this article. In the first place, the story of such a piece of gear is in itself interesting. Secondly, as mentioned earlier, it is proposed to use this gear to obtain measurements which will be quoted in this journal, relating to the high-quality audio equipment that will undoubtedly be featured in future issues. It is only by describing the measuring equipment and its performance in detail that those who take their audio seriously will be able to see whether or not our quoted distortion figures are reasonably in line with what should be expected. Further, the measurement of distortion, and even the interpretation of results, are complicated matters, with the result that quoted figures really mean very little unless the characteristics of the measuring equipment are known, together with the exact methods of measurement that are used.

SIMPLIFIED VERSION

Another reason for publishing the complete circuit of the intermodulation meter is that it is possible, with the aid of an oscilloscope, to dispense with a good deal of the equipment needed when the final result is to be given by a meter indication.

In order to use the 'scope as the measuring portion of the instrument it is only necessary to have the two-tone signal generator, and the measuring circuit up to and including the attenuator which follows the high-pass filter. At this point the signal consists of the high-frequency tone, modulated by the low-frequency one, and if this is displayed on the oscilloscope, using a time-base synchronized with the low-frequency tone, the degree of intermodulation may be measured by LeBel's method, as described in the Radiotron Designer's Handbook (4th edition), on page 614, etc.). The main limitation of the simplified method is that it is difficult to apply, and not very accurate, at really low percentages of modulation of the high-frequency tone. Thus, for measurements on high-quality equipment, the meter presentation is preferable.

BASIC DESIGN FEATURES

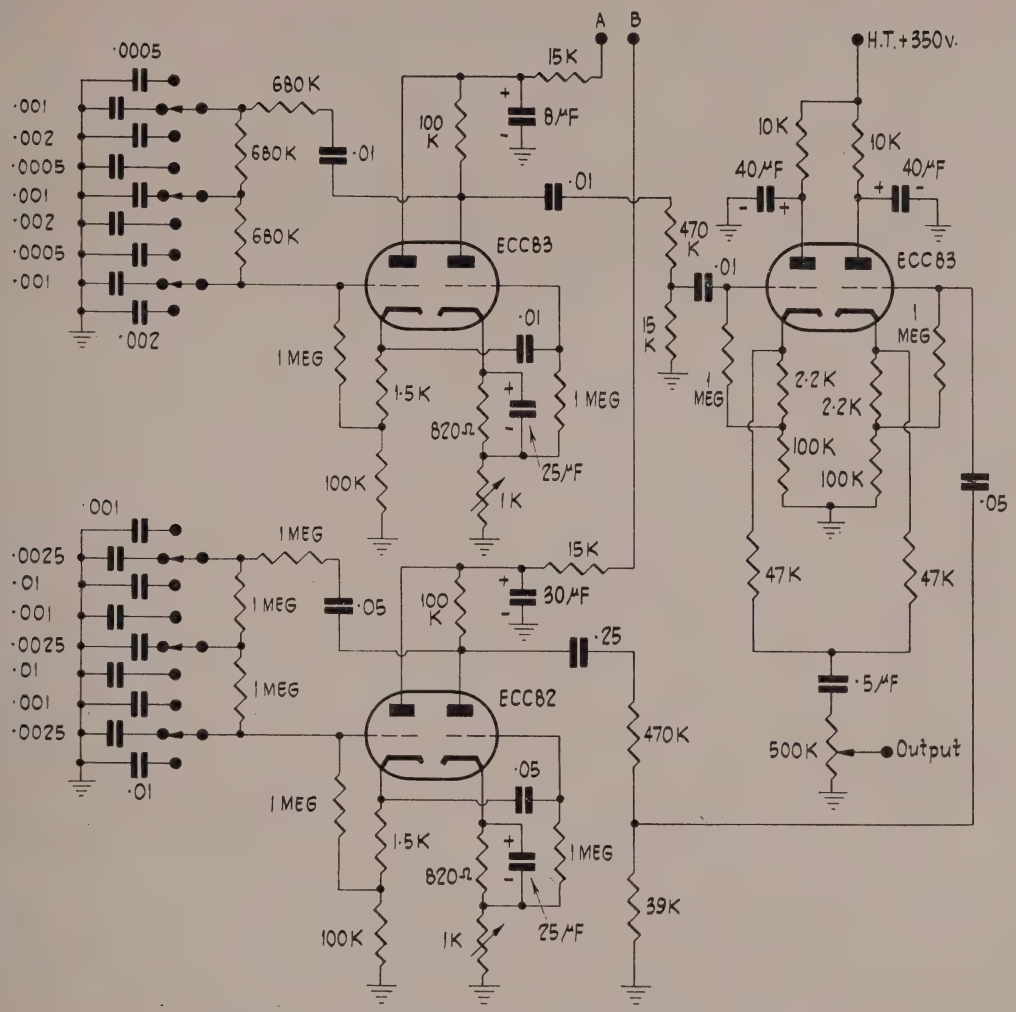
In starting on the design of an intermodulation meter, the first decision to be taken concerns the exact method of measurement to be used. There are two standard methods, one known as the S.M.P.T.E. method, and the other, the C.C.I.R. method. The first, which was devised by the Society of Motion Picture and Television Engineers, in the U.S.A., is the one in commonest use, and is the one on which the present instrument is based. Indeed, except for one important detail, this actually is the S.M.P.T.E. method.

The method uses a special two-tone signal, in which one tone is high in frequency, and the other low. These are combined (for convenience in a special circuit) and fed to the amplifier under test. Since no amplifier is entirely free from distortion, the amplifier acts as a modulator, and the signal issuing from it consists of the original tones, together with intermodulation products, the amplitude of which it is proposed to measure. If the low-frequency tone, and any harmonics of it that may have been generated, are received, all that is left will be the high-frequency tone and the intermodulation products, all of which are quite close to it in frequency. The distorting property of the amplifier under test has in fact modulated the high-frequency tone by the low-frequency one, and by its harmonics, so that if after filtering, the high-frequency tone is displayed on an oscilloscope. it has all the appearance of a carrier wave, modulated by some fairly irregular waveform. The remainder of the circuit of the intermodulation meter is nothing more in principle than a meter for measuring the depth of modulation of the high-frequency carrier. This is done by passing the modulated carrier to a detector, which extracts the modulation and passes it on to a vacuum-tube voltmeter, so arranged that it reads the amplitude of the modulation relative to the original carrier's amplitude.

All this is simple and straight-forward enough, but when it comes to actually doing the job, it is found that a number of not altogether obvious difficulties crop up. These we will meet in due course. Having decided to use a modified S.M.P.T.E. method, the requirement for two oscillators, and a combining, or mixing circuit is settled. These must all be as free from distortion as possible. If the waveform of the oscillators are not pure, the instrument's readings at low intermodulation percentages are likely to mean very little. Distortion in the mixer circuit is even more regrettable, because if it exists in measurable quantity, the test signal itself will contain intermodulation products which the rest of the instrument will be unable to distinguish from those produced by the amplifier under test and which will therefore be wrongly debited against the amplifier. Purity of oscillator waveform has been ensured by using suitable RC oscillators, arranged so that they are just barely oscillating. The mixer is an arrangement of two cathode followers, feeding their outputs to a common load resistor. This arrangement has been found to be exceedingly free from distortion. Indeed, when the signal is fed directly to the measuring circuit instead of through a test amplifier, the reading obtained is one corresponding to 0.05% intermodulation. This figure includes the residual hum and noise generated in the measuring circuits themselves, so that the low level intermodulation in the test signal can readily be appreciated.

The next thing to be decided upon is the smallest output signal from the amplifier being tested that the meter is to handle. Upon the figure chosen will depend the amount of amplification needed in the measuring circuit. This amplification should preferably be as small as possible, because once the test signal is received from the equipment under examination, it must not be further distorted in the measuring circuits; otherwise the measured distortion may be greater than the real figure, which would again make the tested amplifier appear worse than it really is. On the other hand, it is necessary to measure the distortion present in quite small voltages, because amplifiers must be tested at low power outputs, and because it may well be found necessary to measure distortion in voltage amplifying stages, again at small output voltages. In practice, the most commonly tested objects will be amplifiers which have low-impedance output transformers. This means that even at quite high power levels the output voltage will be small. For this reason, a power of 50 milliwatts in a 4-ohm load was decided upon as the smallest voltage that it would normally be found necessary to measure. Thus the target value for the smallest usable input voltage to the measuring circuit was fixed at 0.45v. R.M.S., or 0.62v. peak.

Working from this, as the minimum signal voltage to be encountered, it is not difficult to obtain an estimate of the signal voltages needed at various parts of the system, as represented by the block diagram of the equipment. This signal voltage is handled by the cathode follower input stage, and is great enough to give no difficulty with hum or noise. The cathode follower feeds the high-pass filter, which has negligible loss itself, but which will have an output of approximately one-half the voltage fed to the input of the cathode follower. The reason for this will be seen later. Thus, the signal at the input to the high-pass filter is approximately 320 millivolts peak. Since the filter removes the low-frequency part of the signal, and as this has four times the amplitude of the high-frequency tone, the latter will have an amplitude at the input, and output, of the



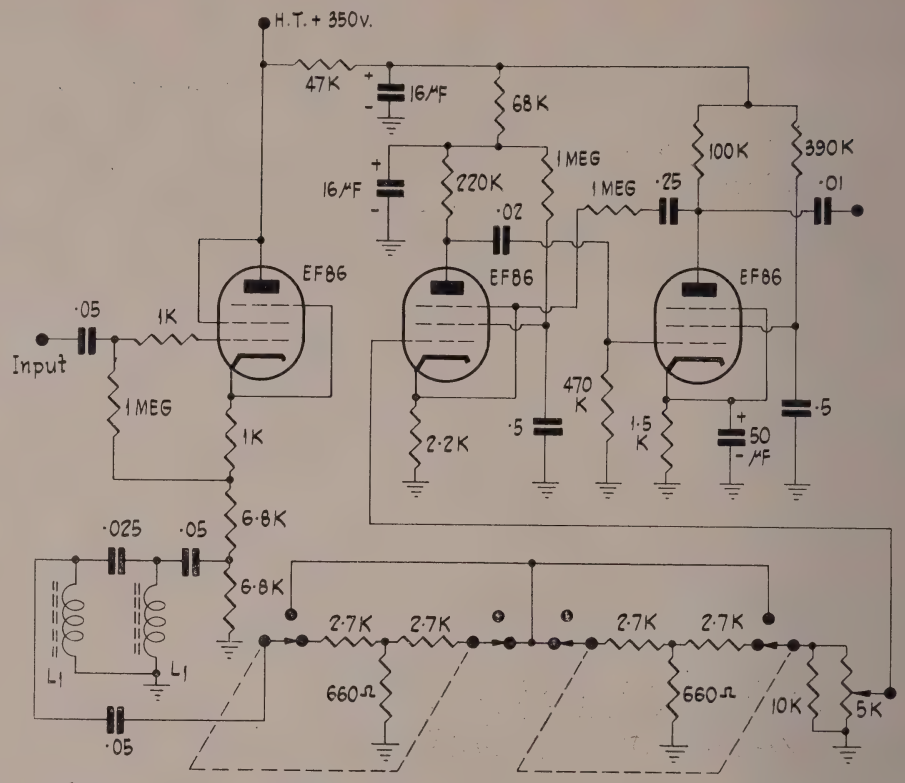
Circuit of the two oscillators and the mixing stage. The 1k. variable resistors are panel controls for adjusting the amplitudes of the oscillator outputs to the required 4 : 1 ratio. Pre-set frequencies are 40, 160, *and* 400 *c/sec., and* 2000, 4000, *and* 8000 *c/sec.*

high-pass filter of 320/5 or 64 millivolts peak. This is the signal upon which the measuring part of the circuit must work, and it is not very large. After the high-pass filter, the signal goes to an attenuator, whose use will be seen later. It is adjustable, and in the minimum-signal case we are discussing now, it will be set at zero attenuation, so that it can be ignored for the moment. The modulated signal of only 64 millivolts peak must now be amplified, because no known detector circuits function properly on such a small signal. We propose to use a diode detector, which means that the signal (i.e., the high-frequency carrier) should be amplified up to at least 10 volts peak before being detected. The amplifier following the attenuator in the block diagram should therefore have an amplification of some 160 times, should have an undistorted output voltage of more than 10 volts peak, and should introduce no hum or noise into the signal. This specification is not too difficult to meet now that low-noise, low-hum valves like the EF86 or Z729 are freely available, and a suitable circuit has been evolved, and is illustrated in Fig. 3. This diagram gives the full circuit from the input cathode follower to the output of the amplifier. The latter uses two EF86s, pentode connected, and but for the use of negative feedback, would have much more amplification than is required. The feedback, taken from the plate of the second stage to the cathode of the first, has the dual function of reducing the gain to the required figure, and reducing distortion to a low figure. Another good feature is that the feedback causes a considerable reduction in the output impedance of the amplifier. This is important because it has a distinct bearing on the efficiency of the detector, which is fed directly from the plate of the second stage.

SUCCEEDING CIRCUITS

As far as the circuits printed in this instalment take us, then, we have removed the low-frequency

components from the test signal, and are left with a modulated high-frequency carrier which has been built up by amplification to a level of 10 volts peak. We can now estimate the requirements of the circuits which follow. The detector will give a large low-frequency output when the intermodulation percentage is high, but when it is small, the detector output can be very small also. If we regard the high-frequency components as a normal modulated carrier, it is clear that 100% modulation would give an output from the detector equal to the peak carrier amplitude. If it is assumed that the detector efficiency is constant at all modulation levels, 1% modulation of a 10v. peak carrier voltage should result in a detector output of 10/100, or 0.1 volt peak. This means that if we want the meter to read 1% full scale on its lowest range, it must have a full-scale sensitivity of at least 0.1 volt. The best way to accomplish this is to use a relatively insensitive V.T.V.M. circuit, preceded by an amplifier.



Circuit of the input cathode-follower, high-pass filter, attenuator, and first amplifier.

A desirable feature of all meters is that the scale should be linear, but it is very difficult, if not impossible, to design a V.T. voltmeter reading directly from the voltage to be measured, that has a linear scale below 1 volt. On the other hand, if the meter is designed to read 10 volts full scale, the readings will be sensibly linear over the whole scale, so that the problem of making a V.T. voltmeter read 0 – 100 millivolts, and yet have a linear scale, can only be solved easily by using a meter whose basic range measures 0 – 10 volts, preceded by an amplifier with a gain of 100 times.

In the conventional diode dectector, as used in radio receivers, the modulation is of very much lower frequency than the carrier, so that it is not a very difficult matter to remove the R.F. from the detector output by means of a simple RC filter. In many radio sets, the only R.F. filtering is given by the capacitor connected across the detector load resistor, but here, the "carrier" has a frequency of only 4000 c/sec., with modulation components which may be as high as 1000 c/sec. or so. Because of this, simple RC filters cannot be used to remove the carrier from the output of the detector, and properly designed LC filters have to be used. Filters of this type are difficult to make if they are to be used in high-impedance circuits, so that they are always built for impedances of a few hundred, or at most a few thousand ohms. The detector circuit, on the other hand, is a high-impedance one, so that some matching device must be used between the output of the detector and the input of the filter. The same difficulty exists with regard to the high-pass filter at the input of the measuring circuit, and in both cases, cathode followers are used as matching devices. The filters have both been designed for an impedance of 3.3k., and in order to achieve enough attenuation in their respective stop bands, two sections have been used in each. Now the business of matching the filters to the cathode followers is not as simple as may appear at first sight, and this question in itself is large enough to be the subject of a separate article, so we will not discuss it in full here. The final result, however, is that approximately 40% of the signal voltage at the input of the cathode follower appears at the output of the low-pass filter; this means that the metering circuit must have additional amplification in order to make up for this loss, so that the amplifier following the low-pass filter must have a gain of approximately 250 times.

(To be continued)

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RECORD TALK

by JOHN GRAY

In the world of records, the Clef label is to jazz what Oiseau Lyre is to early music, or Cetra to Italian Opera. Not for Clef the effusions of Tin Pan Alley or the grind of Rock and Roll: it concentrates on the jazz "greats" whose desire to entertain is matched by a genuine seriousness of purpose. Here you will find Oscar Peterson and Buddy de Franco, Gene Krupa and Johnny Hodges, featured on their own individual discs or combining their talents in the Norman Granz "Jazz at the Philharmonic" series. Philip Warren Ltd., who handle this important line, are also branching out to embrace other labels: Oriole, Delyse, Esquire, Verve and the new Australian "Planet". This is typical of the expansion going on everywhere in the sphere of recordings, and New Zealanders are being offered more variety than ever before. Oriole, for instance, has the full recording of "Salad Days" taken from the London Show (MG20004), and the McCarthy satire "The Investigator", which is still a brilliant piece of work even though it may have lost some of its topicality (MG20006). There is even the much-discussed "Sounds of Time" set, still in its 78 album form. Delyse provides a mixed bag, ranging from a dance medley by Tim Clayton's Quintet (EJ3177) through a selection of operatic numbers sung by a Welsh tenor, Brychan Powell (EC3136) to a harpsichord Partita of Bach's played by Stanislav Heller (EC3135). There are also some very pleasant discs of Welsh traditional numbers.

Bing Crosby's name turns up regularly in the Festival pop series—he must be the most durable singer in the business and has lived to see his style accepted by practically everybody. (At least when people complain about the degeneration of popular singing nowadays you can be certain they are not referring to Mr Crosby, as they were twenty years ago!). How many records he has actually made must be quite incalculable, but he must lead in the popular field by quite a long way, and even in the more serious field, would be rivalled only by Peter Dawson and Richard Tauber, both of whom began recording years before he did. On a ten-inch LP we can hear some of Crosby's evergreen "Western" hits (FR10-975) and on a brand new 78 he is pumping fresh life into "Honeysuckle Rose" and "Swanee" (FS1030). Other Festival and Coral releases seem to embrace everything from film sound tracks to single pop numbers. The sound track records from straight-out musicals like "Show Business" (FR12-982) and the more recent "Anything Goes" (FR12-1003) are sure to attract a large public. The latter features many of those fine Cole Porter tunes which so excited us when they were new. There is also the original stage cast of "Oklahoma" going through their paces in a re-release of the famous record (FR12-937) which may keep us reminded of the tunes whilst we await the arrival of the film (the sound track of which, by the way, is already available from Capitol on SAO595). Those who like to recall Al Jolson's singing have three LPs to choose from, and if they remember his early films they will certainly want to know that among the numbers revived on these discs, "Liza" is on FR10-998, "Sonny Boy" on 999 and "Is it True What They Say About Dixie?" on 1000, and that each of the three records features seven other numbers as well.

Festival, as you know, is actually an Australian company, and in a new 12-inch LP it has made a worthwhile gesture towards Australian ballad composers and singers. This is a collection of songs by well-known song writers over there, and it has been produced under the direction of their commercial broadcasting stations, originally for their own use but subsequently sanctioned for public sale. There are a dozen or more songs, each sung by a well-known artist, including several who became known here with the Australian National Opera two years ago, and including, by the way, our own baritone Stewart Harvey, who is now very much in demand in Australian musical circles. All the songs are provided with orchestral accompaniment and the disc is exactly suited to the vast middlebrow audience which exists on both sides of the Tasman (FGL12-955).

Two piano concerto recordings claim attention among Festival's classical releases. Paul Badura Skoda manages to combine both of the Chopin concertos on the one record; with accompaniment by the Vienna State Opera Orchestra under Artur Rodzinski it offers exceptional value for the money (Westminister WL5308). For those who like to go off the beaten track without finding themselves in alarmingly strange territory there is Dvorak's only concerto, powerfully played by another Viennese, Friedrich Wuhrer, with the Vienna Symphony Orchestra, on Vox APL 7630. This concerto has all the ingredients which make for genuine popularity, and both performance and recording are fully worthy of it.

Tanza have produced their second LP, Sam Freedman's "Melodies of Maoriland" on ZLP002. Daphne Walker and Bill Wolfgramme's Islanders are featured in these eight of Freedman's songs, most of which have appeared in 78 form, and which are none the less welcome in this decidedly more handy packaging. The same combination have made three new 78s of Hawaiian items, and there are Western-style offerings by Johnny Hamblyn (Z288) and Luke Simmons (Z248). For the rest, Radio Corporation have acquired a shipment of the Russian "Monarch" records (pressed in England), including a very fine performance of the Brahms violin concerto by David Oistrakh (MWL310) and two suites from the Prokofieff ballet "Romeo and Juliet", of which a colour film has been going the rounds. One suite is on MEL701, played by the Leningrad State Orchestra, and the other on MWL307, played by the All-Union Radio Orchestra and coupled with Balakirev's wonderful tone poem "Thamar", a work which is generally thought to have inspired the much better known "Scheherazade" of Rimsky Korsakoff, and which does not suffer at all in comparison with that famous piece of orchestral colour.

The Delta Trading Company have now added Polydor to their list of labels. Some of these are English recordings, but for the most part they are of German origin, and have contributions from the popular pianist Hans Arno Simon, light orchestras such as those of Helmut Zacharias and Werner Muller, and other combinations in a repertoire of tangos and what we might call "cocktail time" piano pieces. There is also a shipment of pop numbers from the re-organized Pye-Nixa group: this lot includes singers like Edmund Hockridge, piano pieces from Frank Barclay, and jazz from Lonnie Donegan's Skiffle Group. Amid the classics are the first samples of Sir Adrian Boult's Brahms series. The "Philharmonic Promenade Orchestra" which plays for Sir Adrian on these discs, by the way, is no scratch studio affair, but a very famous orchestra which has to disguise itself under the above rather ridiculous title, purely for legal reasons. The first of the Brahms discs contains Symphony No. 1 and the Tragic Overture (NCL16000) and impresses me as being one of the best versions of this oft-recorded symphony. Similarly, the fine record of the fourth symphony is worth anyone's money (NCL16003) and includes also the Variations on a theme by Haydn in its generous playing time. Of special interest to us is a performance of the Tchaikovsky piano concerto No. 1 by Badura Skoda, also with Sir Adrian and his orchestra (NCL16013): the tempo is a little on the fast side throughout but I cannot feel that this is a great disadvantage, for the performance considered all round is a quite thrilling one. The recording, furthermore, yields up one or two details of the orchestral part that I do not remember noticing in previous versions. Other discs from the Delta people include Haydn's trumpet concerto, in a brand new version by the veteran George Eskdale, recorded this time in Vienna (Vanguard PVL7012) and backed by a good performance of the same composer's well known harpsichord concerto in D major—a useful and quite attractive coupling.

More and more pop "singles" are now coming out in 45 versions, and in some ways it is to be hoped that this convenient form will soon be the universal standard. The catalogue numbers are generally the same as for 78s, with slight variations of the prefix. Doubtless there has already been a rush for the latest Stan Freyberg (Capitol F3480), which has his parodies of "Heartbreak Hotel" and "Rock Island Line", less compelling than usual, perhaps, because Presley's original version of the former sounds like a parody in the first place! However, if Mr Freyberg has succeeded in dealing Mr Presley a body blow so early as this, it is no bad thing. Back to the healthy straightforwardness of other entertainers: there are four Winifred Atwell Decca sides to cheer us up. "Dixie Boogie" and "Britannia Rag" are on 45-Y6446, "Poor People of Paris" and "Piano Tuner's Boogie" on 45-F10681. Bonnie Lou will not disappoint her fans with "Little Miss Bobby Sox" on NZP46, and Hank Snow's "Keep Your Promise Willie Thomas" on HR10268 can be safely left to the "Western" collectors: if they happen to be of an appropriate turn of mind they may care to investigate HR10251 on which one Porter Wagoner is heard inquiring "What Would You Do if Jesus Came to Your Home?" Sincere it may well be, but I decline to make further comment.

A long-playing record of Luigi Infantino (Columbia 33OC 7501) will revive memories for quite a number of people. The singer is well remembered here and his material, stemming, of course, from the Neapolitan waterfront, is of the type with which he scored his outstanding successes. A "Vera Lynn Concert", which the favourite singer recorded at a Guards' depot in England, will also have its eager public. Included are several tunes which were popular only a few months ago (Decca LKM 4120). Another singer whose voice and style yield equal satis-

(Concluded on page 51)

NOTES ABOUT NEW BOOKS

RADIO VALVE DATA

Characteristics of 2,500 valves and C.R. Tubes. Compiled by the staff of "Wireless World". 5th Edition. Published for "Wireless World" by Iliffe and Sons Ltd., Dorset House, Stamford Street, London, S.E.1. Price 4s. 6d. Postage 6d.

The latest edition of this widely used reference book contains full operating data on over 2,500 types of British and American radio valve, 37 transistors, and 300 cathode ray tubes.

The main tables give electrical characteristics of each valve with the base connections shown diagrammatically, the main tables being keyed to the series of diagrams. Nineteen full pages of diagrams. The main tables further classify the valves into current, replacement or obsolete types, as recommended by the makers. An index enables any valve to be found immediately in the tables, while the full list of equivalents has been enlarged.

Summary of Contents: Explanation of Tables; Tables of Valve Characteristics; Frequency-changers, Screened Tetrodes and Pentodes; Output Valves 1; Output Valves 2; Output Valves 3; Thermionic Diodes; Non-thermionic Diodes; Point Transistors; Symmetrical Transistors; Junction Transistors; Amplifier Triodes; Small Transmitting Valves; Valve Rectifiers; Metal Rectifiers; E.H.T. Rectifiers; Cathode-ray Tuning Indicators; Barretters; Voltage Stabilizers; Thyratrons; Television Cathode-ray Tubes; Oscilloscope Cathode-ray Tubes; Efficiency Diodes; Explanation of Valve-base Connections; Tables of Valve-base Connections in Diagrammatic Form; Trade Names and Manufacturers' Addresses; Index and Equivalents.

GUIDE TO BROADCASTING STATIONS, 1956-57

Compiled by the staff of "Wireless World". 9th Edition. Published for "Wireless World" by Iliffe and Sons Ltd., Dorset House, Stamford Street, London, S.E.1. Price 2s. 6d. Postage 4d.

Contains operating details of 3,000 or more broadcasting stations of the world. Some 700 European stations operating on long and medium waves are listed both in order of frequency and geographically. Nearly 2,000 short-wave broadcasting stations of the world operating with a power of not less than 1 kw. are also listed, with their call signs, in order of frequency and geographically. Operating details of Europe's v.h.f. broadcasting stations, which now total nearly 400 and 170 television transmitters also included.

RCA ELECTRONIC TRAINING SERIES—HANDBOOK OF ELECTRONIC CIRCUITS

Published by Government Service Department, RCA Service Company, Inc., Camden, N.J., U.S.A. Obtainable through Amalgamated Wireless (Australasia) Ltd., P.O. Box 830, Wellington.

The ability to recognize a fundamental circuit combined in a diagram with other circuits is often a measure of an individual's proficiency in electronics. To the design engineer with years of experience behind him, such recognition is easy. To the electronics trainee, this recognition is difficult. The electronics man in between these two extremes frequently requires a refresher when he is confronted with a circuit with which he is not too familiar.

In all three categories a practical and concise reference source of circuit information is invaluable for the reason that few can be expected to retain in their minds all the details of all basic circuits. This manual is intended to serve such a purpose for all whose daily work has anything to do with electronic circuits.

The handbook contains circuit diagrams and circuit descriptions of a number of the most commonly used basic electronic circuits employed in both commercial and military equipment. In addition, an analysis of each circuit is included with respect to the most common causes for failure. The basic circuits illustrated are the foundation upon which are constructed all kinds of electronic devices from simple receivers to complex computers. A number of examples is provided of previously published production-type equipment schematics, complete with extraneous refinements. These diagrams serve to illustrate some of the applications of basic circuits in actual practice, and help the student to recognise basic combinations.

PETITION OF RADIO CORPORATION OF AMERICA AND NATIONAL BROADCASTING COMPANY, INC., PRESENTED TO FEDERAL COMMUNICATIONS COMMISSION, WASHINGTON, D.C., FOR APPROVAL OF COLOUR STANDARDS FOR THE RCA COLOUR TELEVISION SYSTEM (June 25, 1953)

Most interesting material is contained in this weighty volume which contains the whole of the petition of the Radio Corporation of America and the National Broadcasting Company, Inc., presented to the Federal Communications Commission, Washington, D.C., on the subject of colour standards for the RCA colour television system. With their feet firmly on the ground, RCA have gone into the whole question most exhaustively and the results of their labours may now be gauged by the success with which colour TV is now achieving in America.

"R & E" TECHNICAL PHOTOGRAPHS

Copies of original designs produced in our laboratory and featured in these pages are available. Prices are: Size 6 in. x 4 in. 3s. 6d.; 8 x 6, 4s. 6d.; 10 x 8, 5s. 6d. Please remit cash with order to Radio and Electronics (N.Z.) Ltd., P.O. Box 8022, Wellington.

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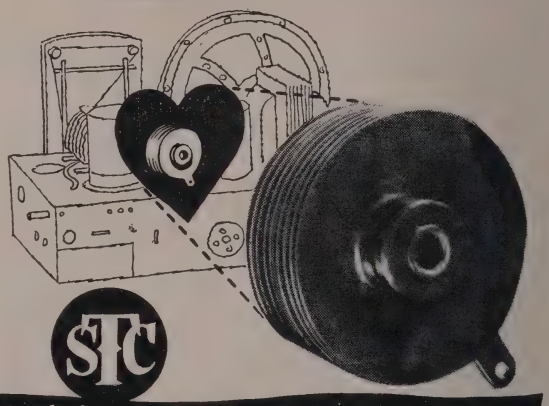

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ELECTRICAL AND TRADE SECTION

PLANNING THE MODERN SERVICE DEPARTMENT

By GEORGE WHITBY

(This covers the main points of an article printed in "the Wireless and Electrical Trader," Vol. 97, No. 1264, which might prove of interest to New Zealand readers)

INTRODUCTION

In an article of this type it is best to idealize and leave the reader to compromise where necessary. Obviously some of the suggestions will not be acceptable for one reason or another, but the possibilities will be appreciated and can be adapted easily to individual circumstances and requirements.

This is a survey of the siting and layout of a service department in which stress is laid upon time saving and congenial working conditions. As a result, the examination of this particular aspect of servicing organization is necessarily detailed.

In repetition work this detailed examination is known as time and motion study and no great benefit is immediately apparent from applying its principles to radio servicing. However, in a job that is as much mental as physical, the logical layout of the department, the reduction of irritating incidentals and the general consideration of working condition is of inestimable importance, imposing less fatigue upon servicing staff and allowing them to be more efficient as a result.

SITING THE SERVICE DEPARTMENT

Sufficient attention is rarely paid to this point when a dealer decides to install a service department in his business. Yet a little thought about the most suitable room can pay dividends once the department is functioning. Far too often the service workshop is "fitted in" where space or a room is available and not infrequently the result is both inconvenient and unsatisfactory.

The site chosen should be on the ground floor and preferably, but by on means necessarily, facing north or north-west with adequate window-space. Its immediate surroundings should be quiet and it should not be too remote from the sales side of the business so that the dealer, if he so desires, can make it an item in his sales-talk and allow prospective purchasers a glimpse of his service department at work —thereby illustrating his ability to offer an adequate after-sales service.

The room itself should be large enough to accommodate everything of relevance without causing congestion and should have easy access, preferably through a separate entrance, to the place where the delivery van is loaded and unloaded. Incidentally, carrying receivers through the shop should be taboo at all times, although this is an accepted practice which is none the less bad. The invasion of a crowded shop by assistants carrying bulky receivers tends to give a very poor impression—particularly if a customer receives a sharp blow in the back!

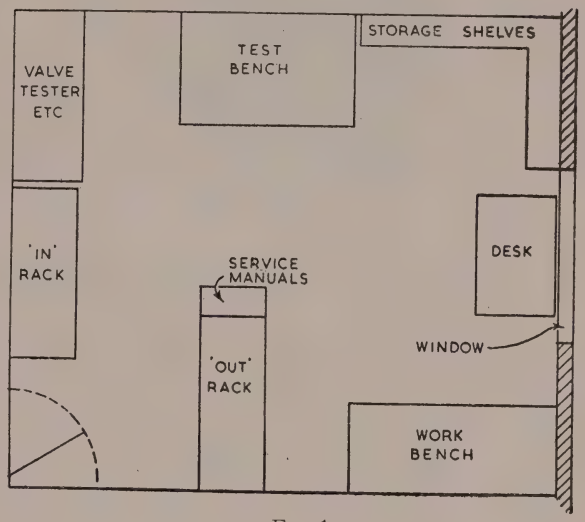


FIG. 1.

LAYOUT

Figure 1 shows a specimen layout that not only reduces unnecessary movement to a minimum but is also logical in its arrangement. Receivers (and other equipment) coming in for service are stored on a rack immediately inside the door, whilst the outgoing rack is facing the door, so that it is not necessary to enter the servicing area to lodge or remove receivers at any time.

Starting at the doorway and going clockwise around the plan, it will be noted that the incoming rack is followed by a bench or table, on which is mounted the valve tester, inductance/capacity bridge and any other instrument which is used for component testing and may need to be employed independently of the fault diagnosis and repair equipment on adjacent test bench.

Next to the test bench is a rack of shallow shelves for the storage of valves and components. A cupboard for this purpose adds little to the facility and has the disadvantage of having doors which have to be opened, consuming valuable floor space.

Under the window is either a small table or desk, where the service engineer can sit to cope with necessary clerical work and this is followed, against the fourth wall, by a workbench which is far enough from the service bench to allow both to be used simultaneously without congestion. The outgoing rack,

running at right angles to this bench, is similar to the incoming rack, but has shelves fitted at one end to accommodate service manuals, etc.

The doorway leading to both shop and delivery van entrance (where this exists) is clear of obstruction and the door itself opens against the wall to allow unimpeded access to both racks.

LIGHTING

Adequate lighting is obviously a necessity, for poor illumination of the working surfaces is very detrimental to good workmanship—particularly in the crowded space of a receiver chassis.

If the room has a northerly aspect the maximum amount of natural light is available at all times, and this helps to cut lighting costs as well as making the room more congenial. However, it is important in such a room that neither test-bench nor work-bench should be near the windows, because this position would be found disagreeably warm in summer with the sunlight pouring through them and, whatever the aspect of the room, the area near the glass will be uncomfortably cold in winter. The position of both benches ought, therefore, to be against the inside

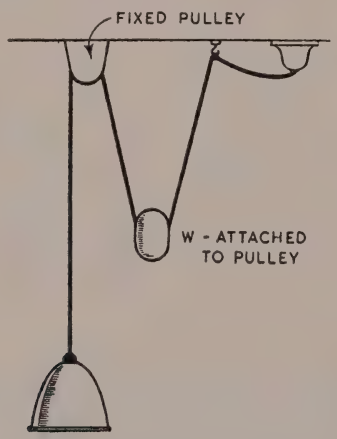


Fig. 2. *Simple method of arranging an adjustable bench lamp with counter-weight.*

walls, and artificial lighting should be used for close work at all times.

For general lighting, fluorescent tubes are neat and economical, largely offsetting their relatively high initial cost, but whatever type of lighting is decided upon, the holders should be fitted so that the ceiling is illuminated, otherwise the result will be both depressing and inefficient. The lamps should also be suitably spaced so that "deep" shadows are eliminated.

The benches, on the other hand, should either be fitted with adjustable lamps or an arrangement adopted as shown in Fig. 2. If adjustable lamps are used they should not be too flexible otherwise the slightest accidental touch will knock the light from the required position. Figure 2 shows an acceptable alternative, but the light is not horizontally adjustable and this is sometimes a disadvantage. The weight W should be approximately equal to the combined weight of lampholder, lamp and shade, but some experimenting would be necessary to obtain absolute stability. The weight of the fitting is taken off the ceiling rose by attaching a loop to the flex and hanging it on a ceiling hook, as shown.

HEATING

This is sometimes a problem when reflector-type or open fires are used. These have the advantage of a quick source of heat, but it is initially confined to a well-defined area and, when the room is eventually warmed, the heat in this area will be excessive. Space heating has much to recommend it because the room is heated without such areas of excessive heat.

Bearing in mind the fact that too much heat is nearly as uncomfortable as too little, the heating system should be thermostatically controlled at an agreeable working temperature and, to be absolutely effective during the winter months, should be switched on continually—leaving the thermostat in complete control. The heaters will then be switched only to maintain the selected temperature and will not have to cope with the expensive task of heating a cold room every morning.

DECORATION

This item is occasionally neglected, but it is of sufficient importance to warrant some consideration, particularly if the dealer intends to invite customers to view the department. Additionally, a bright workroom will assist the servicing staff to keep it clean and tidy as well as promote clear thinking.

It is as well to remember that a multiplicity of colour can be both distracting and irritating, and an acceptable scheme utilizes two main colours—a light, washable distemper for the walls and a pastel-shaded enamel for the benches, shelves and other woodwork, with the ceiling finished in white to improve lighting efficiency.

The floor should have a non-slip surface which is easily cleaned and does not show footmarks too readily, and for this purpose a plain, hard-wearing linoleum with a matt surface is eminently suitable. Duckboards could be placed near the benches to prevent excessive wear at these points as well as to provide warmth for the feet when standing for prolonged periods in cold weather.

COMFORT OF STAFF

The degree to which this is considered is very dependent upon the attitude of the individual dealer, and the matter can be easily dismissed without further thought. However, the wise employer will provide a certain standard of comfort for his staff and by doing so, encourage them to take pride in their department and in their own workmanship. Furthermore, as already stated, the work of the service engineer is in part a mental exercise—and is tending to become more so—so a degree of comfort will assist him in his work.

In this article lighting, heating, and workroom decorations have all been considered and these, with suitable seating facilities (a necessity when particularly intricate work has to be done), constitute the major items for comfort, and staff in a servicing department where these have been covered are unlikely to wish for any better conditions under which to work.

LATEST OVERSEAS DEVELOPMENTS

A NEW LOW-COST CARDIOID MICROPHONE FROM TURNER

A new cardioid microphone, the Model 98, has been introduced by the Turner Company. It combines modern, compact design with outstanding directional characteristics.

In construction, the single active element is a rugged moving coil type with plastic diaphragm. The Model 98 cardioid is designed for quality performance at a lower cost than any other cardioid of comparable quality.

Technical specifications are—Output: — 52 db. Response: 65-11,000 cps. Front-to-back ratio: 20 db. Impedance: 50 ohm, 200 ohm, Hi. 20 ft. removable cable, single conductor shielded on high impedance models, 2 conductor shielded on low impedance models. Dimensions: 6¼ x 1½ x 1.

Further details are available from Turner Company, Export Division, 89 Broad Street, New York 4, New York.

RCA MINIATURE TELEVISION CAMERA AND TRANSMITTER

The Radio Corporation of America has announced the introduction of a radical new transistorized miniature television camera and portable transmitter for spot news telecasting and other TV field pick-up functions. Perhaps the most compact, complete system yet designed for picking up and transmitting television pictures, it includes a 4 lb. camera equipped with a novel electronic viewfinder, and a 15 lb. back-pack transmitter capable of sending TV signals to a base station more than a mile away. It represents a major achievement in broadening the flexibility of television as a highly effective tool for gathering and instantaneously transmitting information from practically any location.

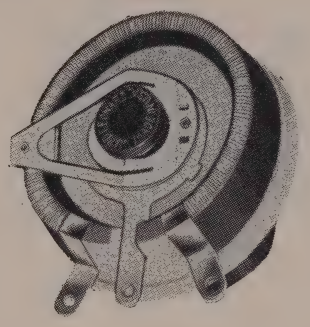
With the exception of the transmitting and pick-up tubes, the equipment is entirely transistorized, using seventy transistors. The transistorized camera is built around a new RCA developed Vidicon television camera tube only ½ in. in diameter, and no longer than a king-size cigarette, and employs any standard 8 mm. motion picture camera lens. In spite of its small size, the developmental tube has a sensitivity greater than that of the standard 1-inch Vidicon pick-up tube commonly used in portable TV cameras.

The camera is equipped with a novel electronic viewfinder which can be detached from the camera and hung around the cameraman's neck. Since it is electronically synchronized with the camera, the finder displays a scene as viewed by the camera lens even when the two elements are separated in this fashion. For example, a cameraman could look down into the viewfinder to observe a scene being picked up by the camera while the latter is held overhead to see over a crowd or other obstacle.

Exclusive of the viewfinder, the developmental camera is only 2½ inches high, 3 inches wide, and 8¼ inches long. All necessary circuitry and controls are contained within this compact unit, which feeds directly into the back-pack transmitter housing a synchronizing generator, transmitter and power supply.

The back-pack transmitter, also completely transistorized, weighs only 15 pounds, complete with batteries, as against approximately 50 pounds for previous portable transmitter equipment with tubes. The pack is 12 inches wide, 13 inches high and 3 inches deep. The batteries employed with the unit can operate the camera and transmitter for about 5 hours, in contrast to the two-hour life of batteries employed with tube-operated equipment.

NEW HI-SHOCK RING RHEOSTAT



A new 50-watt Ring Type Rheostat designed specifically for use in electronic and industrial control equipment where severe mechanical shock is encountered has been announced by the Ward Leonard Electric Company.

Designated as Type N152, these ring rheostats are designed to meet requirements of specification MIL-R-15109 and the HI Shock requirements of MIL-S-901.

Construction: Base, core and collector ring support assemblies are made of high dielectric strength glass-bonded mica. The toroidally core-wound resistance wire is secured with a silicone compound, separating the turns and protecting the wire. Balanced "twin contact" shoe construction eliminates backlash and assures smooth, positive control.

Features: Shock resistant (Class HI), Class C insulation, "twin contact shoes" designed for smooth operation and minimum wear on resistance wire.

Ratings: 50-watts continuous duty standard resistance tolerance + 20 — 10 per cent. max. resistance value 20,000 ohms.

On special order, Type N152 rheostats can be supplied with tapered windings, shaft extensions, tandem mountings and other accessories.

Complete details are available from Ad. Auriema, Inc., 89 Broad Street, New York 4, N.Y.

INDUSTRIAL TELEVISION

Now in full production at Marconi's works is one of the smallest, lightest, and cheapest Industrial Television equipments in the world.

Industrialists have long foreseen that the use of closed circuit television in their plants, workshops and offices could have immense potentialities for time and labour-saving, provided that the price was reasonable. The Marconi Industrial Television Equipment, which sells in the region of £500 to £600, is helping to make the idea a practical reality.

With a power consumption as low as 100 watts (no more than that of the larger size of domestic lamp), the equipment will operate for hours for the cost of one unit of electricity. It may be plugged to any power socket.

The camera measures only 5¼ in. x 4 in. x 11⅜ in. (13.3 cm. x 10.2 cm. x 21.5 cm.). Some idea of the minaturization achieved may be gauged from a comparison of weights with an average studio camera. The latter weighs about 140 lb. (about 63.5 Kg.). The Marconi Industrial TV camera weighs 4½ lb. (2 Kg.) only.

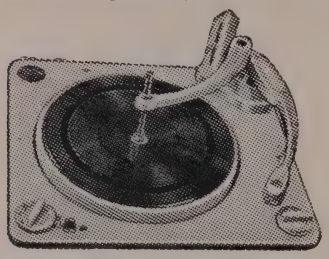
Of equal importance is its simplicity of operation. The camera itself houses only the tube, three valves and associated circuitry, so that the likelihood of faults is reduced to a minimum. After initial setting-up it works unattended, simple control being effected from the remote control point, and requires no more skill than is involved in the operation of an ordinary television set.

(Concluded on page 50)

NEW PRODUCTS: LATEST RELEASES IN ELECTRICAL AND ELECTRONIC EQUIPMENT

This section of our paper is reserved for the introduction of new products and space preference is given to our regular advertisers. For further particulars contact Advertising Manager, R. & E., Box 8022, Wellington.

COLLARO RC456 FOUR-SPEED RECORD CHANGER



The first four-speed equipment to reach New Zealand, the Collaro RC456 fully mixing auto/manual Record Changer has been acclaimed in the trade as yet a further step forward in record changing equipment, and is much in demand.

Apart from the fourth speed of 16⅔ r.p.m., the RC456 has the facility for playing single records manually—a feature much favoured by those concerned with the proper care of long-playing discs. Constant speed change cycle on any record speed is another desirable feature, and RC456 has the distinction of being the only positively jam-proof record changer on the market.

Using the "Ronette" type head, the RC456 lives well up to its claim as fidelity equipment. At only £13 19s. 6d. retail, the demand for this changer is heavy.

NEW HIGH-FIDELITY SPEAKER BY ROLA

The latest speaker from the Rola stable is the "Hi-Fi 12UX" which the makers announce to be the best speaker yet designed and built in their Australian factory.

The "Hi-Fi 12UX" has a high-flux magnetic system, a high-frequency diffuser cone, and a response from 40 c/sec. to 15,000 c/sec. Its free-cone bass resonance is at 40 c/sec., enabling it to give smooth response at least down to this frequency. This journal has had an opportunity of hearing one of the first of these speakers to come to this country, and was favurably impressed with its extended range, and smoothness of response, which put it well inside the ranks of the high-fidelity speakers available from other makers. Voice-coil impedance is 15 ohms—a departure from Rola's usual practice, which will appeal to users on account of the virtual standardization of this impedance for high-quality speakers.

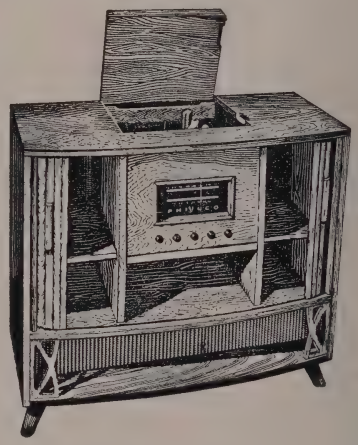
COLLARO 4/564 FOUR-SPEED SINGLE PLAYER

Also just released is Collaro's new four-speed Single Player. Employing the "Ronette" turn-over head, this player retails at £8 8s. and at this price will be a popular choice.

COLLARO TAPE TRANSCRIPTOR

A tremendous amount of interest has been shown in the new Collaro Tape Transcriptor Deck, which has so far only been released in the "deck only" form at £29 15s. retail. An addition to the range will incorporate the pre-amplifier, power pack and oscillator with associated controls, and is expected to sell below £60. Using four heads (two "Record/Play" and two "Erase") and operating at speeds of 3¾, 7½ and 15 inches/sec., the Collaro Tape Transcriptor is a most versatile piece of equipment at a truly remarkable price, and has been acclaimed by all who have heard it in action.

NEW PHILCO "HOLLYWOOD"



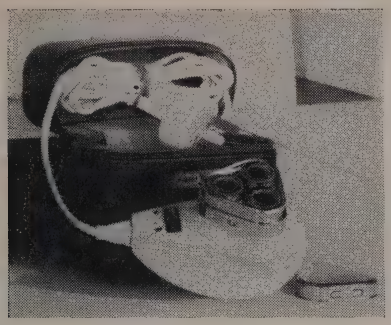
The newly released Philco "Hollywood" Model 1662 incorporates many improvements on its top-selling predecessor, Philco Model 1661, including more accessible record changer (four-speed Collaro RC/456) in top of cabinet with "touch-latch" lid, increased record space, separate bass and treble tone controls, three speakers in crossover network, and seven-tube chassis.

The same very attractive and quite original cabinet has been reduced in height by 3 in. to conform with design trends.

The "Hollywood" is, of course, a dual wave radiogram and sells at only £93 10s. retail. Available in Blonde or Warm Brown finish.

Philco radios are manufactured by Dominion Radio and Electrical Corporation Ltd., Auckland, under licence from Philco Corporation, Philadelphia, U.S.A., and are distributed throughout New Zealand by Russell Import Co. Ltd., Wellington, Auckland, and Christchurch.

PHILISHAVE HEADS THEM ALL.



The shape of shaves to come—the Philishave DIPLOMAT—introduces a third rotary cutting head for greater speed and efficiency in dry shaving.

There is a story behind the naming of the "Diplomat". In these days of international conferences and lightning visits we have got used to the idea of seeing foreign ministers hopping on and off jet airliners. Urgent notes are exchanged daily by half-a-dozen governments. Speed and efficiency mean a lot during every diplomatic mission. And these are the two principal qualities which have set the Philishave "Diplomat" above all previous dry shavers. Owners of the "Diplomat" are men interested in external affairs, interested in that neat and clean appearance which so often distinguishes the successful and quality-questing man.

The "Diplomat", released throughout New Zealand last month, has successfully achieved a fivefold aim:

(1) To make shaving faster than ever before. This is achieved by the extensive shaving area and by the silver-steel cutting blades which are self-sharpening. Rotating at 3000 r.p.m. with 60 radiating slots on each cutting head, the Philishave "Diplomat" makes 54,000 razor actions per minute.

(2) To make shaving smoother than ever before. This is achieved by the 60 radiating slots in each of the three cutting heads. They radiate like the spokes of a wheel, so that neither long nor short hairs can escape the cutters, no matter what the angle of growth. There is no need for you to press hard when shaving. The beard is cut cleanly because the "Diplomat" moves so effortlessly over the skin.

(3) To make shaving closer than ever before. The outside rim of the "Diplomat" gently stretches the skin to bring it to uniform contact with the extra large shaving surface. The cutter guard is only 1/350th of an inch thick so that the blades can cut at skin level.

(4) To make shaving easier than ever before. This ease can be noticed immediately when feeling the balance and shape of the "Diplomat" because it fits the hand comfortably. A further aid to effortless shaving is the long detachable cord which plugs straight into the mains socket. Cleaning of the "Diplomat" is just as simple as with the Philishave doubleheader.

(5) To make shaving cleaner than ever before. The "Diplomat" has a large hair chamber which traps all the cuttings — none fall on your clothes. You can thus shave with a "Diplomat" whilst dressed in a dinner suit, which dilomatic people do indeed so often wear.

-◈◈-

A NEW RECORD LABEL FOR NEW ZEALAND

Coming available soon on the New Zealand market is a completely new record label—RCA Records—from the fabulous studios of RCA Victor of America.

All the advantages and vast resources of this internationally renowned label plus the company's more than half-a-century's experience of merchandising in one of the most competitive countries in the world are to be made available by the New Zealand distributors—Radio Corporation of New Zealand Limited. This will give condence to all record retailers who look for big profits and a large turnover.

(Continued on page 52)

HOWARD WIRE CUTTER

Slender Extended Cutting Members . . . for the TIGHT Spots.

True Radial Shearing Action . . . to eliminate "DULLING".

Pistol Grip with Thumb Lever . . . for Handier Operation.

Cuts Clean — 36 ga. to 16 ga. . . . for most Diversified Work.

Heat Treated Cutting Members . . for STRENGTH and longer life.

Constant 10 to 1 Leverage . . . for Greater Power.

Positive Spring Return . . . for Convenience.

Retail Price: Only 48s. 4d.

Obtainable from

FRED ROTHSCHILD & SON

79 - 83 PRETORIA STREET LOWER HUTT.

P.O. BOX 170. TEL. 61-698.

TRADE WINDS

COLLARO SUCCESS IN NORTH AMERICA

In a short sales drive in the United States and Canada, Collaro Ltd., report taking orders in excess of three hundred thousand Record Changers, worth four million dollars. In the year ended March last, two and a quarter million dollars' worth of Collaro Record Changers were exported to America.

◈—◈

PYE—MERCURY TIE-UP

Stockists of gramophone records will rejoice in the announcement that Pye Limited have been appointed sole New Zealand distributors of Mercury discs.

Mercury stars, Patti Page, Frankie Laine, The Platters, and so on, already have a huge following, and the record-buying public are clamouring for the latest hits of Mercury artists heard in recent films. Indeed, Mercury claims high places in the world's "Hit Parades".

Dealers can be assured that the usual sales vigour and service so characteristic of Pye will apply also to their handling of Mercury records.

To cope with this new line and ensure prompt attention to dealers' requests, Pye are extending their Auckland premises, for record merchandising today is a fast-moving business calling for a highly organized company with sound marketing methods, good promotion and knowledgeable management. The trade as a whole cannot fail to benefit from this great Pye-Mercury tie-up.

As Pye get into their stride, more will be heard of the two other labels associated with Mercury—Emarcy and Wing. The former has a world-wide reputation for high-class jazz recordings, while Wing is a label covering jazz, pops, and classics.

Trade inquiries for Mercury, Emarcy and Wing records should be directed to Pye Limited, Record Department, P.O. Box 2839, Auckland.

◈ ⊞ ◈

FREE CATALOGUE TO THE TRADE

Following our September announcement of the production of a new loose-leaf catalogue by Messrs Fred Rothschild & Son, we are now happy to announce that this is available free of charge to the trade only.

◈ ⊞ ◈

SIMPSON FIFTY YEARS IN THE INSTRUMENT BUSINESS

Founder of the Simpson Electric Company of Chicago, Ray R. Simpson recently celebrated his "Golden Anniversary" in the instrument business.

Attesting the world-wide acceptance of Simpson instruments, an album containing suitably inscribed photographs of more than sixty distributors and representatives in overseas areas, was presented to Mr Simpson. Among those whose photographs are included in the album is Mr J. Eckford, of Tee Vee Radio Ltd., Auckland, distributor of Simpson instruments in New Zealand.

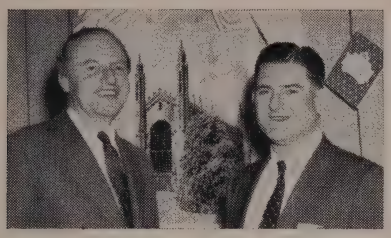
TWO RADIO "INSTALLATIONS"

At the cocktail party following the recent conference, at Wairakei, of the N.Z. Radio and Television Traders' Association (Inc.) "chains of office" were presented to Mr W. J. Murphy and Mr Garth Wilson, elected chairmen of the wholesalers' and retailers' groups at the conference.

CLASSIFIED ADVERTISEMENTS

Rates 4d. per word, minimum charge 3s. Deadline date 1st of month preceding publication.

VISITOR SAYS TV POSSIBLE IN 12 MONTHS



Mr Peter M. Threlfall (left), an executive director of Pye Ltd., England, with Mr George A. Wooller, chairman and managing director of Pye Ltd., New Zealand, and also an executive director of Pye Ltd., Cambridge.

On a short visit to New Zealand, Mr Peter M. Threlfall, an executive director of Pye Ltd., England, had some pungent comments to make concerning recent statements about TV made by members of Parliament.

"The comments are unsoundly based", was his verdict. "For example, the remarks of Mr Barnes (Govt., St. Kilda), that people were invited out for a night and all they did was to sit in semi-darkness and look at television, were quite untrue. Rooms are not darkened for TV and no one in England or America would tolerate sitting in semi-darkness. Nor would they allow TV to monopolise all their thoughts and dictate all their actions and behaviour."

Referring to the remarks of Mr Moohan (Opposition, Petone) who considered that the problem would be not so much the establishment of TV as the keeping of it going, Mr Threlfall said, "Let me, as an expert in TV, assure Mr Moohan that ample TV programme material is available now. As time goes on the choice will be wider and there will be an ever increasing stock of entertainment, instruction, news and documentaries from which to choose. Above all, the price of such programmes will be economic, and certain sources will have material costing nothing at all."

In conclusion, Mr Threlfall pointed out that even Thailand had installed TV three years ago. Today, TV was well established in 27 countries, and Caracas, capital of Venezuela, ran three independent commercial stations. "New Zealand needs TV now," he declared, adding that if a licence were issued people could be "viewing" within 12 months.

NEW ZEALAND DISTRIBUTORS FOR AMPEX CORPORATION OF U.S.A.

In our September issue we referred to the appointment of Amalgamated Wireless (Australasia) Ltd., as sole New Zealand representatives for the Ampex Corporation of the U.S.A.

There has now been some alteration in this arrangement, and A.W.A. have secured the sole representative rights in Australia for the Ampex Corporation of the U.S.A.

Messrs W. G. Leatham of 43 Taranaki Street, Wellington, have been appointed sole New Zealand distributors for the Ampex Magnetic Recorders and associated equipment.

Ampex of America is pre-eminent in the development, design and manufacture of magnetic recorders. Recently they have produced the first commercially successful magnetic recorder for television.

Literature and full sales information can be obtained from W. G. Leatham Ltd., P.O. Box 1284, Wellington, to whom all inquiries should be addressed.

OLYMPIC COMMUNICATIONS

The Post Office in Australia is well ahead with the complex communications set-up the administration and reporting of the 16th Olympiad in Melbourne will demand.

Since 1952 a special Post Office team has been working with the Olympic Organizing Committee making ready.

Extraordinary facilities will be required by the world press. Already it is known that 800 accredited representatives will attend the Games. On a conservative estimate, they will lodge about 10,000 words every hour for overseas. Additionally, there will be heavy internal press.

Thousands of radio photos will be lodged. Special facilities to transmit these are being provided.

Large batteries of teleprinters, in total about 120, will be established in the Olympic Stadium. They will be capable of being switched direct to overseas radio-telegraph links—for example, direct to London or via London direct to other European centres for reception simultaneous with transmission from the stadium.

All overseas transmitters in the country will be brought into use. The extensive installation of the Overseas Telecommunications Commission will be supplemented with Army, Navy and Air transmitters.

Information

A special Post Office bureau staffed by telephone operators speaking French, Spanish, German, Italian, and Dutch will provide a round-the-clock information service for competitors and visitors. Each operator will speak at least two languages, English and another. Other interpreters will stand by to cope with other languages.

The telephone number of the bureau will be M-OLY-16—short for Melbourne Olympic Games 16th Olympiad. (The Australian telephone service uses letter prefixes, as do the British.)

Control

For the control of the Games, an elaborate internal telephone system will be provided at all places where events will be held. All the cables for this, including underwater cable for the control of the rowing events at Lake Wendouree, have been laid.

Special communications for Police, Fire, and Ambulance men and at Olympic Village for the competitors are being installed.

The Olympic telephone work alone involves a network equivalent for a town the size of Masterton, with additionally 2000 special telephone terminals, and a large number of switchboards.

Postal Facilities

At Olympic Village and at main event venues full post offices will operate.

A special issue of postage-stamps is being made. The question of special postmarks at the many places where events will be held is at present being considered by the Australian Post Office.

Broadcasting

In Australia the Broadcasting Service is controlled by the Post Office. Elaborate arrangements for commentators are being made.

It is known already that 107 commentators from 32 countries and 36 different organizations will attend. They will need facilities for immediate live descriptive broadcasts of events, for delayed broadcasts (tape recordings), for editing tapes.

Fifty studioettes will be established in the Olympic Stadium for sports commentators Behind these studioettes will be a main broadcasting control centre.

Mr. M. R. C. Stradwick, Assistant Director-General of the Australian Post Office, who is in charge of the Olympic Communications organization, states "We are confident that the communications facilities provided in Melbourne will be the equal, at least, of those provided in any other Olympic city. All concerned are co-operating enthusiastically to ensure that the communications for the Games will not only be adequate but will reflect credit on Australia generally."

For the Technician

THE SIMMERSTAT

(Reproduced from the "Practical Electrician's Pocket

The Simmerstat is an "electric tap"; it is a unit that opens and closes a snap-action switch, the control knob determining the proportion of time "on" to time "off". In this way the average power input to a hotplate or other heater can be regulated. A schematic diagram is given in Fig. 1, and it will be seen that the snap-action switch is operated by a lever "driven" by a heated bimetal strip. The distance the strip must travel to operate the switch, and hence the frequency of operation, is determined by a cam coupled to the control knob.

The switch automatically compensates for fluctuations up to ±15% in mains voltage and also for variations of temperature in the switch itself. Able to replace the normal three- or four-heat switch, the Simmerstat measures 2¼ x 2¼ x 2 15/16 in. overall within the cooker switch compartment. In Britain there are two types: The TYC 2.5 kW rated at 250V A.C. or 2 kW at 110V A.C., and the TYK for 5 kW at 250V A.C. The latter incorporates a second switch that closes in the "Full" position, to allow the use of both windings of a two-circuit plate for quick boiling, reverting to one circuit only for simmering. Each switch must not be loaded at more than 2.5 kW.

Connections for both types of Simmerstat are shown in Fig. 4.

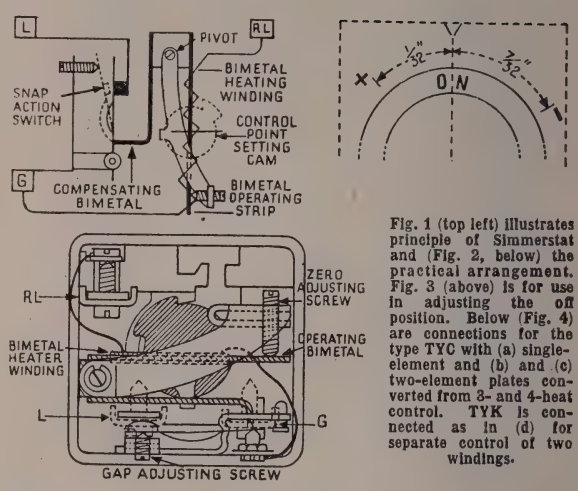
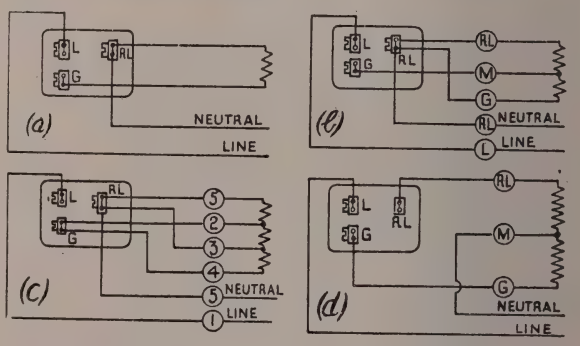


Fig. 1 (top left) illustrates principle of Simmerstat and (Fig. 2, below) the practical arrangement. Fig. 3 (above) is for use in adjusting the off position. Below (Fig. 4) are connections for the type TYC with (a) single-element and (b) and (c) two-element plates converted from 3- and 4-heat control. TYK is connected as in (d) for separate control of two windings.



SIMMERSTAT SERVICE

To check if bimetal winding is open circuit, turn knob to "Full", remove cover, connect supply to terminals RL and G. In 10-15 minutes, the bimetal should expand so that the distance between the compensating and operating bimetal has increased by approximately 1/16 in. Alternatively, measure the resistance of the winding which should be within these limits: 110V, 1,100–1,300 ohms; 200–250V, 5,500–6,500 ohms; 380V, 16,500–18,500 ohms.

GENERAL INSPECTION

Inspect the Simmerstat for cleanliness. The steel block to which the operating and compensating bimetals are welded should be free on its pillar. Check this by first holding the Simmerstat with the spindle pointing downwards, and then inverting the Simmerstat, i.e., turning it through 180°. When the Simmerstat is inverted, the bimetal assembly should fall freely under its own weight along the pillar to the extent of the available clearance. For this check, the knob must be in the "Full" position.

On inspection of the silver contacts of the micro-switch after some months of service, it will be found that the surfaces of both are regularly pitted over an area which may vary from 1/22 in. in diameter to ⅛ in. in diameter, according to the length of service. This is a normal condition providing the pitting is not so serious that the contact gap has been decreased or increased outside the limits mentioned below. If the pitting is fairly heavy, it is advisable to clean the contacts before re-adjusting the contact gap and this should be done in the manner described below. Check that the two legs of the micro-switch leaf spring are fitted in the bottom of the V-groove in the bracket and that the ends of the legs are parallel with the line of the bottom of the Vee. The switch should not be twisted.

If it is necessary to clean the contacts, the gap setting screw should be turned back to widen the gap sufficiently to permit a small file to be used on each contact surface in turn. Under no circumstances should emery paper or polishing fluid be used. The contacts should be filed until all evidence of pitting has been removed. It is not necessary to burnish the contacts as a fine file finish is most suitable for a switch of this current rating. After setting or cleaning the contacts, the gap should be adjusted by means of the setting screw so that it is between 0.009 in. and 0.011 in. Standard pattern feeler gauges may be used for measurement, but care must be taken to ensure that, when setting the gap, no force is necessary to insert the feeler in the gap; otherwise the terminal pillars may be forced apart, thus making the gap appear larger than it is.

If the contacts are found to be in a good condition, it is advisable to check the gap before touching the adjusting screw, as no adjustment may be necessary.

After checking the above-mentioned points, test for satisfactory operation of the switch by turning the knob to the "Full" position and operating the switch by pressing on the bimetal with thumb or finger. The switch should snap open or shut with a sharp click, and there should be no evidence of sluggish action or slow make and break. The zero setting may be checked as follows: (a) If the knob is turned to the "Off" position, it will be found that the centre of the word "Off" coincides approximately with a short line on the porcelain base. This line, which is formed as the dividing wall between two short V-grooves, is the zero mark to which the Simmerstat is set during manufacture. (b) Mark the knob with fine pencil lines as shown in Fig. 3, which shows an enlarged portion. (c) Turn the kuob to the "Off" position and then rotate slowly to the "On" position. The switch should close between the two lines shown as + and — in Fig. 3. If the closing point lies outside these limits, the setting should be adjusted by means of the zero adjusting screw shown in Fig. 2.

If the setting is below the lower limit, i.e., nearer to the "Off" than it should be, the setting screw should be screwed further into the bracket and vice-versa. During this adjustment care must be taken to support the back of the bracket with a finger to ensure that the force of the screwdriver is not transmitted to the bimetal. Undue force applied to the bimetal may cause over-stressing, which will result in instability in service.

THERMOSTATS

Thermostats for controlling oven elements are of two types, expanding stem and tube, or liquid filled tube. In both cases, expansion due to heat is transmitted to a pivot system in the head of the thermostat and operates the contacts by means of a high ratio lever. Rough handling will affect the sensitive adjustment of the pivot and contacts, with consequent alteration of the calibration.. Oven thermostats are variable between 200° F and 600° F and, depending on the position of the tube in the oven, may be calibrated with an "offset temperature" of up to 50° F between the centre oven temperature and that of the thermostat tube.

Calibration can be checked by means of a thermocouple or clinical type thermometer placed in the centre of the oven.

MISSING AND STOLEN RADIOS

Auckland:

Pacemaker, 5-valve AC/DC portable, serial No. 72820. Brown rexine cabinet 12 in. x 6 in. x 8 in., with cloth speaker grille, dial scale on top of front of radio, and volume and tuning knobs on top of set. Brown leather carrying handle.

Wellington:

Pacemaker model 5/55, serial No. S.N. 49923A. Light green plastic case.

Philips model 246, serial No. 84317. Dark brown bakelite cabinet.

Mullard 6-valve, model 655, portable, serial No. 86362. Maroon-coloured plastic cabinet.

Pacemaker 5-valve, model 5555B, serial No. 54513/171185. Ivory plastic cabinet.

Philips 6-valve A.C. model BZ146U, serial No. 6921. Tan-coloured plastic cabinet with white front, two tuning knobs, one at each end of face. Small crack in glass on left-hand side of dial.

Mullard 4-valve, mantel model 466, serial No. 82218, licence No. 95318. Maroon bakelite cabinet, 10 in. x 7 in. x 5 in., with cream face.

Petone:

Philips auto radio, model 656, serial No. 2432.

Blenheim:

Akkord (Pinguin) short-wave and broadcast portable, serial No. 14720, manufactured in Germany. Beige leather cabinet approx. 10½ in. x 8 in. x 4 in. with centre dial and two-knob push-button control. Three short-wave bands and one broadcast.

Christchurch:

Autocrat 5-valve, 6-volt, car radio. Brown mottled cabinet with two white control knobs, one of which has chip out of it. Dial numbered 1 to 9. Paint chipped off case where aerial plug fits.

Unknown make battery portable. Brown cabinet 14 in. x 8 in. x 6 in. with two control knobs. Identifiable by marks on dial to indicate stations, and worn appearance.

Autocrat 8-valve car radio. Black push-buttons. Eight points on dial.

Philips 5-valve portable, serial No. 75843, patent No. 87617. Red-brown plastic cabinet.

Courier AC/DC portable, serial No. 119690. Yellow cabinet 14 in. x 8 in. x 8 in., with curved top and side and back panel removed. White plastic flex with black plug.

Dunedin:

Bell model 5B5 radio, serial No. 27130. Plastic cabinet with square dial with three control knobs.

Invercargill:

Philco 5-valve, dual wave, model 521, table model radio, serial No. 59089. Brown bakelite cabinet with slotted hardboard back.

Te Puke:

Clipper Eight, model C.R.8U5 car radio (without speaker), serial No. 71468, finished in blue-grey colour.

Mt. Maunganui:

Skyscraper portable radio, serial No. 171256; cream colour cabinet.

Marton:

Golden Knight 5-valve broadcast battery vibrator set, the 6-volt wet battery and the vibrator being in separate units; veneered cabinet 18 in. x 15 in. x 9 in., with speaker above oval dial.

Lower Hutt:

Clipper 5-valve, dual-wave, mantel model 524, serial No. 53692; ivory plastic cabinet with red plastic grille and four ivory tuning knobs on front.

Capeharte clock radio in light oak case, square glass dial similar to clock face at left front, white plastic grille at right front, two white tuning knobs on right hand side of cabinet.

Bell AC/DC four or five-valve portable radio in brown plastic case with white handle and control knobs.

Philips Air Ranger 6-valve broadcast car radio with receiver and speaker in one unit; two control knobs.

Wellington:

Mullard portable radio, model 104611, serial No. 75734: maroon plastic cabinet 10 in. x 8 in. x 4½ in., with small carrying handle at top and tuning eye at centre near bottom of set. Four tuning knobs at front.

Philco portable radio, model 546, serial No. A76939 with maroon plastic case.

Philips model 146, serial No. 4981; tuning range 535-1600 Kc/s. Maroon cabinet 10¾ in. x 6½ in. x 5 in. with cream front.

Philips auto radio in three parts: Tuning unit push button type, 10 in. x 6 in. x 2½ in., bronze Hammerlux finished metal case, serial No. 63872/76172. Vibator unit in brownish-khaki coloured metal perforated case, 8 in. x 5 in. x 3 in., serial No. 5419/50862. Loudspeaker unit, standard make, 5 in. in diameter, chromium plated casing.

"HUMANITY'S BOON — NOT DOOM" CANADIAN I.R.E. CONVENTION-EXPOSITION

In Toronto, Canada, on 1st, 2nd, and 3rd October this year, over 90 of Canada's leading manufacturers will be exhibiting their latest in radar, radio, television, control mechanisms, computers and a host of related products, including transistors.

Peace-time atomic applications will also be shown, the emphasis being on "Humanity's Boon—Not Doom".

Electronic devices will dominate the show. Since radio, radar, and electronics and many aspects of nuclear science overlap, the exposition will have a composite appeal to technicians, engineers, and scientists, to specialists in medicine, physics and agriculture, as well as to business and efficiency experts.

There will be a wide range of electronic devices for aircraft and ground station equipment, including landing systems, and at least one designer of guided missiles will show some of the latest developments in that field.

Essential in Canada's development, the radio industry will be prominent in this exposition. The Canadian Broadcasting Corporation in its French-language network alone uses 3,200 miles of landline, and its Trans-Canada English-language network uses 6,700 miles. In its broadcasting of important events such as the Queen's yearly Christmas message to the Commonwealth, it uses as much as 10,000 miles of landline to tie-in all its 27 broadcasting and television stations. In addition, there are 186 private stations in Canada.

A considerable amount of television equipment of various kinds will also be shown.

The exposition will have added interest to firms whose operations make use of computers, or to executives who wish to know the scope, versatility and adaptability of these revolutionary devices. Now considered indispensable by many large corporations, computers also serve amongst other things in research, weather forecasting and traffic control. One series of papers to be read at the convention will deal with the sorting of letters by an electronic machine being developed for the Canadian Post Office.

An excellent agenda of technical papers has been arranged for the convention which runs concurrently with the exhibition. These cover subjects relating to medical electronics (for diagnoses and treatments), scatter propagation, and application of electronics to atomic energy projects, the use of computers in automation and engineering problems, as well as several papers dealing with transistors, and one covering magneto-resistive amplifiers.

This is the first full-scale and the most ambitious radio-electronics presentation ever seen in Canada, and is expected to attract many leading specialists and executives of other countries.

THE SPECS ARE THE PROOF . . .
FOR BEST BUYS, BUY EICO.

Engineers and Scientists in the News

SUCCESSES IN AERONAUTICS

F/O B. A. Woods, of Winton, and Mr. R. C. Davison, of Wellington, have both won awards recently at the College of Aeronautics at Cranfield, England.

Flying Officer B. A. Woods, B.E. (Mech.), who is a member of the Defence Scientific Corps serving in the R.N.Z.A.F., has been studying for the past two years at the College of Aeronautics at Cranfield, England. Reports from London state that Flying Officer Woods has just been awarded a First Class Diploma in Aeronautics, and in addition has won the Governor's Prize as the best all-round student, and the Woods of Colchester Prize in Aerodynamics. The fine record of New Zealanders at Cranfield is being maintained.

Mr R. C. Davison, M.Sc., A.M.I.E.E., A.M.N.Z.I.E., who is a member of the Air Department, was awarded an Aeronautical Research Scholarship by the Minister in Charge of Scientific and Industrial Research in 1954. He began his studies at the College of Aeronautics at Cranfield, England, in October, 1954. News has been received from London that Mr Davison has been awarded a First Class Diploma in Aeronautics and has won the Woods of Colchester Prize in Aircraft Electrical Engineering. He has, during the past year been President of the College Students' Society, a very active body. Arrangements are being made for Mr Davison to join the Royal Aircraft Establishment in England for a year's further training before he returns to New Zealand to continue his work in Air Department.

MORCOM GREEN, EDWARDS PRIZE

The methods for the analyses of insecticides used in agriculture may result in the increased effectiveness of pesticides. This year a chemical research award has been given for this work.

The Morcom Green, Edwards Prize, offered yearly through the New Zealand Institute of Chemistry for the encouragement of original research by younger chemists, has been awarded this year to Mr I. R. C. McDonald, M.Sc., of the Dominion Laboratory, Department of Scientific and Industrial Research. Mr McDonald is a member of the Wellington branch of the New Zealand Institute of Chemistry.

The prize was instituted in 1951 and four out of the six given have been won by staff of the Dominion Laboratory. They are Mr I. K. Walker, M.Sc. (1951), Dr. B. B. Marsh, M.Sc., Ph.D. (1935), Mr C. F. Denmead, B.Sc. (1954), and Mr I. R. C. McDonald, M.Sc. (1956). This is a striking tribute to the standard of the work of the Dominion Laboratory.

Mr McDonald has developed original techniques, using a double beam infra-red spectrophotometer, and it is now possible to determine accurately the proportions of the toxic substances present in insecticide formulations. In assessing the value of an insecticide it is essential to have this information.

(Concluded on page 50)

RADAR AND RADIO AT THE FARNBOROUGH AIR SHOW

(Notes supplied by the Radio Industry Council, Great Britain)

A new multi-channel micro-wave radar link which can carry three radar or television pictures was demonstrated in public for the first time at the Farnborough Air Display organised by the Society of British Aircraft Constructors, and held in September last.

This Marconi equipment operates on the 4,000 Mc/s frequency band, with an R.F. bandwidth of 24 Mc/s. The video bandwidth is approximately 8 Mc/s. To show how much information can be conveyed within this bandwidth the Marconi Company relayed from London Airport to its stand at Farnborough (a) the basic or "raw" radar picture from the Marconi Type S232 Airfield Control Radar installed at the Airport, (b) the same picture from which permanent echoes had been supressed by the Moving Target Indicator, (c) a television picture of aircraft activity at London Airport, and (d) a sound commentary.

All this information, on four separate channels, was transmitted via only one of these new radar link equipments.

Each aircraft produced a large, well defined "blip" on the remote radar screens and the direction of travel was clearly visible by its "tail". The Moving Target Indicator also effectively suppressed permanent echoes which would otherwise confuse the picture with unwanted responses in which aircraft movement might be lost.

For this 20-mile relay an intermediate repeater station was used but where opital paths are possible distances up to 40 miles can be covered on one "hop".

Of technical interest is the use of Frequency Modulation (FM)—ensuring a low "noise" level—crystal control of the transmitter and receiver and the use of travelling wave tubes.

This equipment has important advantages for defence purposes for it is seldom that the best site for a radar operations room coincides with the most suitable location for the radar station itself. Now, the display centre can be separated from the radar head and linked by multi-channel radio.

By using a number of repeater stations the radar signals can be relayed up to 250 miles or more before the noise level becomes a limiting factor.

100-MILE RANGE SURVEILLANCE RADAR

Another feature of the Show this year was a site, just outside the Static Exhibition, devoted entirely to radar equipment.

This included the new Cossor type 21 set, a compact high-power surveillance radar incorporating an optional Moving Target Indicator (M.T.I.) for suppressing permanent echoes.

This set works in the 10 cms band. A vertical coverage of from 0 to 45 degrees above the horizon is obtained from a 16 ft. horizontal aperture reflector without electronic or mechanical beam tilting.

A range of 60 nautical miles up to 30,000 feet for small aircraft of 15 sq. metre target area and up to 100 miles (nautical) for larger aircraft is claimed by the manufacturer.

200-CHANNEL COMMUNICATIONS EQUIPMENT

Standard Telephones and Cables show a new version of their STR 18-C high frequency communication equipment, the STR 18-D which now covers 200 channels from 2.8—18.1 Mc/s. This is intended for use in large civil airliners such as the Britannia.

Two hundred crystals are used for this equipment and the tuning and channel selection is entirely automatic—in fact, the transmitter tuning and remotely cotrolled aerial tuning is correctly adjusted for any channel before the first word of a message has finished.

INFORMATION FROM 11 MILES UP

A demand has arisen for accurate information on the velocity and direction of winds up to heights of 60,000 ft. (over 11 miles) or more as the result of the ever-increasing operational heights of modern aircraft. To satisfy this requirement Decca has produced a new radar, operating in the 3 cms band, known as the Windfinding Radar.

The same firm showed a prototype Glide-Path Radar which also operates on 3 cms. This has two displays and when used in conjunction with another radar of the Airfield Control or Medium Surveillance type, provides the information for precision approach.

TORCH BATTERY LOUDHAILER

A new lightweight, completely self-contained loudhailer with a range of up to 400 yards or more is shown by Pye of Cambridge.

This is the "Transhailer" and complete with its all-transistor amplifier and batteries housed in the base of the horn, with the microphone, it weighs only 5 lb. The only power supply, consisting of eight small type U11 torch batteries, is said to last, under normal working conditions, for six months before replacement becomes necessary.

SPECIALISTS IN A
SPECIALIZED FIELD.
MR. SERVICEMAN.
Our Universal Coils, types 40 (Aer), 45 (R.F.) and 41 (Osc) will replace any damaged R.F. Coil.
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THE N.Z. HIGH FREQUENCY SPECIALISTS
282 FLORENCE QUAY, WELLINGTON, N.Z.
COILS, I.F. TRANSFORMERS, H.F. CHOKES, B.F.O.'s DIALS, SCALES, COIL ASSEMBLIES, GANGS, BUILT-UP UNITS, ETC.

Revival of the "Giant's Voice"

REVIVAL OF "THE GIANT'S VOICE"

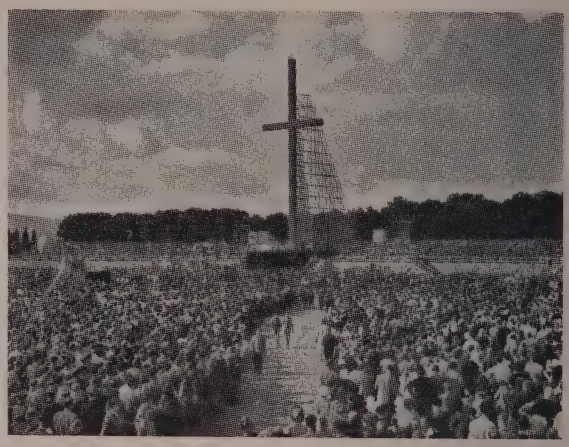
More than 25 years ago the Philips Amplifier Department set out to popularize sound amplification in various countries by giving demonstrations with "The Giant's Voice", a very powerful loudspeaker system for those days. In 1956, however, they broke all records in this respect with their

Giant Philips Loudspeaker Installation at the German Evangelic Church Day, 1956.

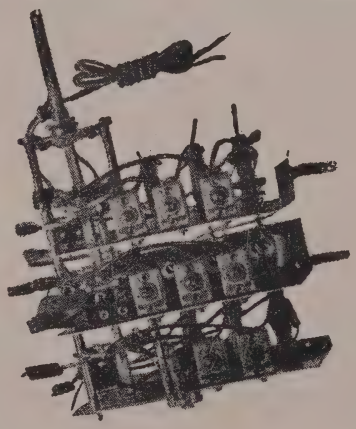
At the final gathering of this congress, held on 12th August in Frankfurt, more than 300,000 participants from various countries were addressed simultaneously.

For this purpose, at the Rebstock aerodrome, a huge Cross was erected (see photograph), in which the vertical pole served as an enormous sound column! Thus, the sound of 250 loud speakers was beamed over an area of 320,000 sq.metres, with a power of 2000 watts. The triple column, distributing the sound in three directions, was 30 metres high and evenly radiated speech and music to people who were listening up to half a mile away. After the event, when the full amplifier power was turned up for police instructions and paging purposes, every word spoken could be understood in the streets of the city at a distance of several miles.

A total of 14 microphones was necessary to transmit the sound of orators, 5000 singers and 2000 trumpeters. Apart from several pre-amplifiers for the microphones, six 750-watt amplifiers type EL6470 were used for feeding the sound column. By dividing the amplifiers and loudspeakers into separate groups, standby switching and individual adaptation to very severe winds were made possible.



The task accomplished at this event showed that even very large areas can be sonorized from a central point if careful planning is applied.



Poly-Q

B-A-N-D
S-P-R-E-A-D

BASIC KIT — TYPE 9

Completely assembled, wired, and tested up to converter tube. Fitted to sturdy 8/9 valve, plated steel chassis. Accurately aligned to dial calibation. You merely add I.F. and audio stages. The spread on shortwave makes shortwave tuning easier than broadcast.

IDEAL as base for really high-quality
RADIOS, TUNERS, RADIOGRAMS, etc.

Details:
49, 31, 25, and 19-metre bands, plus broadcast. Extremely accurate calibration and frequency stability. Split stator tuning condenser and temperature compensated oscillator. Only three simple adjustments necessary to completely align each bandspread. Handsome floodlit dial scale. Effortless tuning from high ratio 24/1, ball-bearing spin wheel drive. Gang isolated from mechanical and electrical vibration and noise. Bandspread calibration linear and marked in 100 k/c divisions and fractions thereof. A 0–100 logging scale also provided. "BAND", "TONE" and "GRAM." indicators fitted. Special A.V.C. system provides shorter time constant on shortwave to rapidly compensate for fading signal. Polystyrene low-loss adjustable slug coils throughout. Full instructions and suggested I.F. and audio circuits.

Price:

£16/19/7 (retail), less valves, plus packing, and postage.
(Valves, £1/5/6; packing, 6/6; postage, 6/6, approx.)

See them at our Stockists, or write direct for full particulars.

INDUCTANCE SPECIALISTS LTD.

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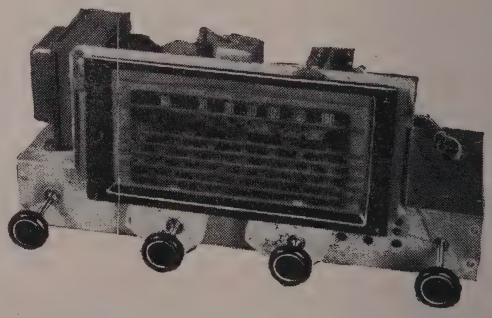

NOTE: Special assembly type B10 available covering amateur bands 15/13, 20, 40, 80, 160 metre bands plus broadcast also available.

CATALOGUE: New list of preferred types available on request; specially prepared folder including list and technical data sheets 2s. 6d.

Collaro Tape Deck

(Continued from page 23)

quired by the head is lower than that needed by the the previous one.

CONCLUSION

In conclusion, it can be said that although a little more work is involved in connecting up the circuits to the Collaro deck, this is not difficult, and in practice it has been found that most excellent results can be obtained with this deck. The frequency compensation of the circuits has been organized for a tape speed of 7½ in. per second, on the principle that this will be the most popular speed. At this speed, the output response is flat from below 40 to over 10,000 c/sec., and this is good enough to provide excellent fidelity. If the same circuits are used on the lower speed of 3¾ in./sec., the upper frequency response will be quite severely restricted, but this will not matter much, because in general longer playing time will be used almost exclusively with speech which does not need the extended high-frequency range so much as music. As for 15 in./sec., it is our guess that the results obtainable on 7½ are so good that few people will bother about using the higher speed, in view of its shorter playing time. If the circuits are used at this speed without modification, the top response is given an upward tilt, equivalent to considerable treble boost, but if the deck is used in combination with an amplifier which has independent bass and treble controls, the treble control can be used to counteract the rising top response thus obtained. However, if a simple piece of switching is incorporated in the amplifier chassis, it would be quite possible to make the response on 15 in./sec. flat from 40 to 15,000 c/sec. quite easily.

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Scientists in the News

(Continued from page 46)

Mr McDonald, son of the late Mr and Mrs R. McDonald of Wellington, was educated at Thorndon School and Scots College before joining the Dominion Laboratory as a cadet in 1942. After two years he enlisted in the Royal New Zealand Air Force in 1944 and served as a navigator until released in July, 1945. He completed his B.Sc. at Victoria University College in 1947, and his M.Sc. in 1948. In 1950 Mr McDonald was seconded to the United Kingdom Department of Scientific and Industrial Research, and for two years was employed at the Forest Products Research Laboratory at Princes Riseborough.

When there's a better switch
ARCOLECTRIC will make it
New Zealand Agents
GREEN & COOPER LTD. WELLINGTON.

Latest Overseas Developments

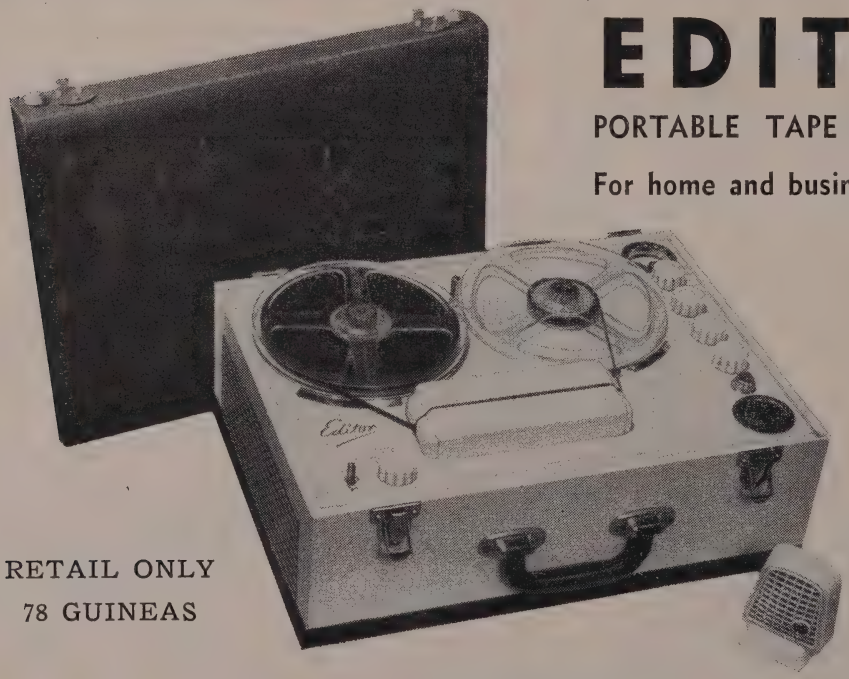
(Continued from page 39)

The Marconi Industrial Television camera does not, of course, in any sense replace the standard television broadcast camera. It is essentially a tool for the Industrial and Commercial fields; a time and money-saver which may well change the pattern of many of the present production techniques.

The camera, or cameras, are merely set up to view a desired scene. The pictures are fed by a cable to a control unit, and thence to a monitor screen, or screens, up to a distance of 2000 feet away from the picture-source.

In this way, for example, a continuous watch may be kept, from a central Control Office, on various instruments located in widely separated points of a factory. Boiler gauges, thermometers, revolution counters and power control-board metres, may now all be monitored from one place, with consequent economy of manpower. Production lines can likewise be co-ordinated, and by means of the overall picture obtained, incipient bottlenecks foreseen and avoided. The checking of water-levels and flow-metres in hydro-electric projects can similarly be carried out. Many industrial processes which have hitherto been too dangerous to view at close quarters may be subjected to minute scrutiny; tests to destruction, the study of the combusion conditions in a furnace, conditions in an atomic reactor, these are a few of the processes which can now be remotely viewed thanks to Industrial Television. In the commercial field the uses of the equipment are no less varied. Railways, banks, and departmental stores, to mention but a few, offer wide scope for the new technique.

EDITOR
PORTABLE TAPE RECORDERS
For home and business recording



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PALMERSTON NORTH: Messrs Andrew Stewart & Sons Ltd., 18-22 King Street.
CHRISTCHURCH: The Gordon Electrical Co. Ltd., 192 Madras Street;
DUNEDIN: Messrs R. H. Gardner & Co. Ltd., 111 Moray Place.

Record Talk

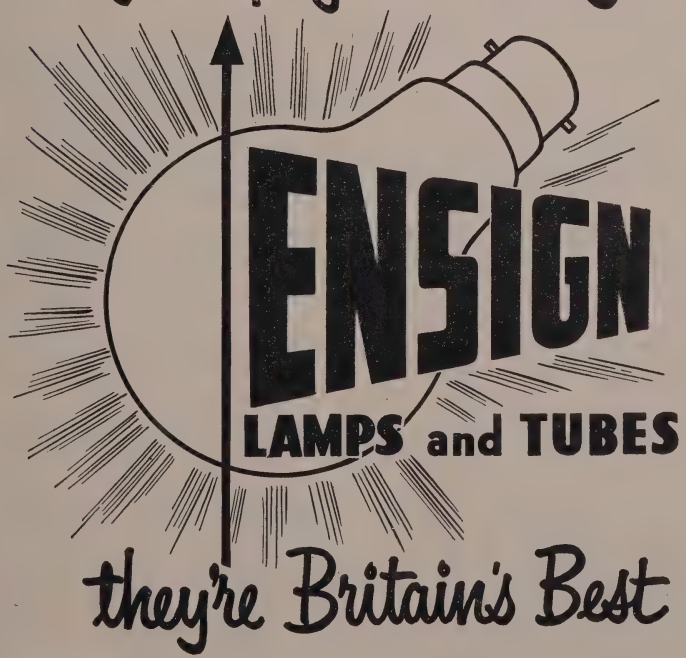
(Continued from page 35)

faction is Gordon MacRae, star of the exquisite "Carousel" film and for long a musical comedy star and ballad singer in his own right. His disc of "Romantic Ballads" (Capitol H537) features excerpts from some of the more outstanding of recent musical shows. Rhythm of the more exotic type may be enjoyed in Les Baxter's "Tamboo" (Capitol H655) eight numbers with an African flavour being paraded for our pleasure, the whole winding up with a rousing rendition of "Zambesi", and while in this mood we may well sample a disc by the well-known Portuguese singer Amalia Rodrigues, odd records of whom have occasionally been encountered in Columbia's continental lists. Here she is represented by a ten-inch LP (33CS14) under the general title of "Fado and Flamenco", and in music which is just right for her commanding personality. Some of the best of the lighter LPs, indeed, are of artists recorded in all sorts of out-of-the-way places.

Classical LPs, as usual, present the problem of quantity. Whichever of the weekly release sheets we examine, there is something that leaps to the eye as a "must" for one's collection. Mahler's "Kindertotenlieder", which may be translated as "Songs on the Deaths of Infants", has a quiet poignant beauty which belies its depressing title, and the heartfelt singing of it by the baritone Fischer-Dieskau proves as persuasive as did his treatment of the same composer's "Songs of a Wayfarer" some months ago. This is a wonderful record for those who want deep satisfaction rather than just excitement from their music, and the singer is beautifully accompanied by the Berlin Philharmonic Orchestra under Rudolf Kempe (HMV BLP1081). Two discs by the English pianist Denis Matthews give us some Mozart and Beethoven in Columbia's cheaper green label series; musically they are both interesting. The Mozart record (33SX 1044) contains two of the more attractive of the piano concertos, the delicious G major K453, which for some reason has been rather neglected of late, and the much bigger and impressive C major K503. Both have the advantage of support from Harry Blech and his London Mozart Players, an organization which has appeared at the latest Edinburgh Festival. On his Beethoven record, Denis Matthews plays two sonatas, the early E flat major opus 7 and the dramatic one in D minor which is altogether one of the most distinguished of the series, perhaps in some ways the most splendid Beethoven produced before he came to the "Appassionata" (33SX 1047).

Decca's series of Russion operas have now arrived at Glinka's "A Life for the Tsar", which was always uncharted territory for us (LXT 5173-6). This is an issue of enormous interest, and I must declare that, somewhat to my surprise, I have found it the most frankly enjoyable of all which have so far come from this source. It has come down in history as the first opera to be completely and distinctly Russian, but it seems to have far more in common with the Italian works of its period, which was 1836. In one respect, however, it runs true to form—I allude to its enormous length. The average French or Italian opera goes comfortably on to two or perhaps three LP records, the average Russian one requires four or even five, with a consequent strain on one's pocket-book, and perhaps readers had better put themselves in a position to try over the discs before they commit themselves to such expenditure. The Belgrade performance is a good one and there is, by the way, a great deal of ballet music in one scene, rather more pleasant than exactly distinguished. For reasons not hard to understand, modern Russia prefers to call the work by its alternative title, "Ivan Sussanin".

After our plethora of Mozart this year, it is in some ways a relief to turn to Haydn by way of a change. Kathleen Long,



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always one of the more tasteful of pianists on record, has made an extremely enjoyable disc of four Haydn sonatas (Decca LXT 5144). The four are chosen from his later works and the music falls into the category of "neglected classics", why, it is a little hard to imagine. Meanwhile, Gieseking's Mozart series goes steadily on. His latest Columbia (33CX 1358) is Volume 9, leaving two more to go; and the disc contains a happily assembled group. The little C major Sonata with its "Eighteenth Century Drawing Room" first movement is balanced by the bigger and more impressive Sonata in F major (K332). There are also two sets of variations and a quite unknown Fantasia in C minor (K396). It would be interesting to know how many people are investing in this complete series, but a point to make is that the record under notice would be an excellent choice for those who would like a really representative sample of the master's piano music, but who would never desire to have everything. Another series which will have wide appeal is that of the Beethoven violin sonatas being made by Yehudi Menuhin and Louis Kentner. Their latest release (HMV ALP 1354) contains the first two of opus 30, the C minor one, in particular, is Beethoven in as intense a mood as he ever achieved in this particular medium.

Sir Adrian Boult is in his high noon as a conductor for LP records. There is his series on Nixa, his excellent London Philharmonic series for Decca, and an almost parallel series he has been making with the same orchestra for HMV. A new disc on the last-named label (ALP 1359) gives a really splendid performance of Elgar's overture "In the South", which, with its sub-title "Alassio", crystallises the English composer's impressions derived from a sojourn in Italy. The piece has always been somewhat neglected, but such a magnificent performance as we have here is all that is needed to persuade us of the music's worth. On the reverse is the same composer's "Nursery Suite", composed a quarter of a century ago and dedicated to our present Queen and her sister. It was almost Elgar's last composition and was a return to the style of his early "Wand of Youth" suites. It is good to see it on records once more. Many people will remember its being played at the Royal Concert given in Dunedin in 1954.

NEW PRODUCTS

(Continued from page 41)

The RCA label here will become a byword of excellence in home entertainment — as is the RCA Victor label in America. Some of the famous artists appearing on the label include, Perry Como, Eartha Kitt, Mario Lanza, Eddie Fisher, Arturo Toscanini, Jan Peerce, Marion Anderson, Arthur Rubinstein, Jussi Bjoerling and many other top liners.

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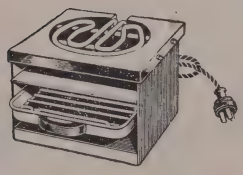

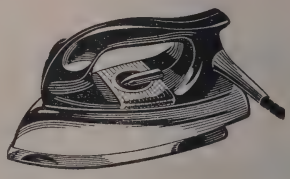

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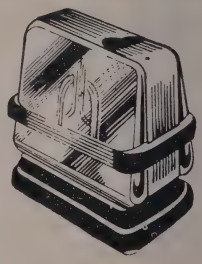

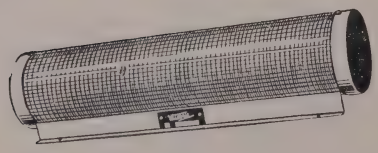

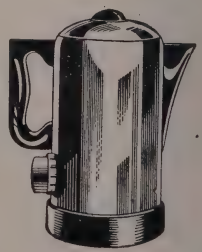

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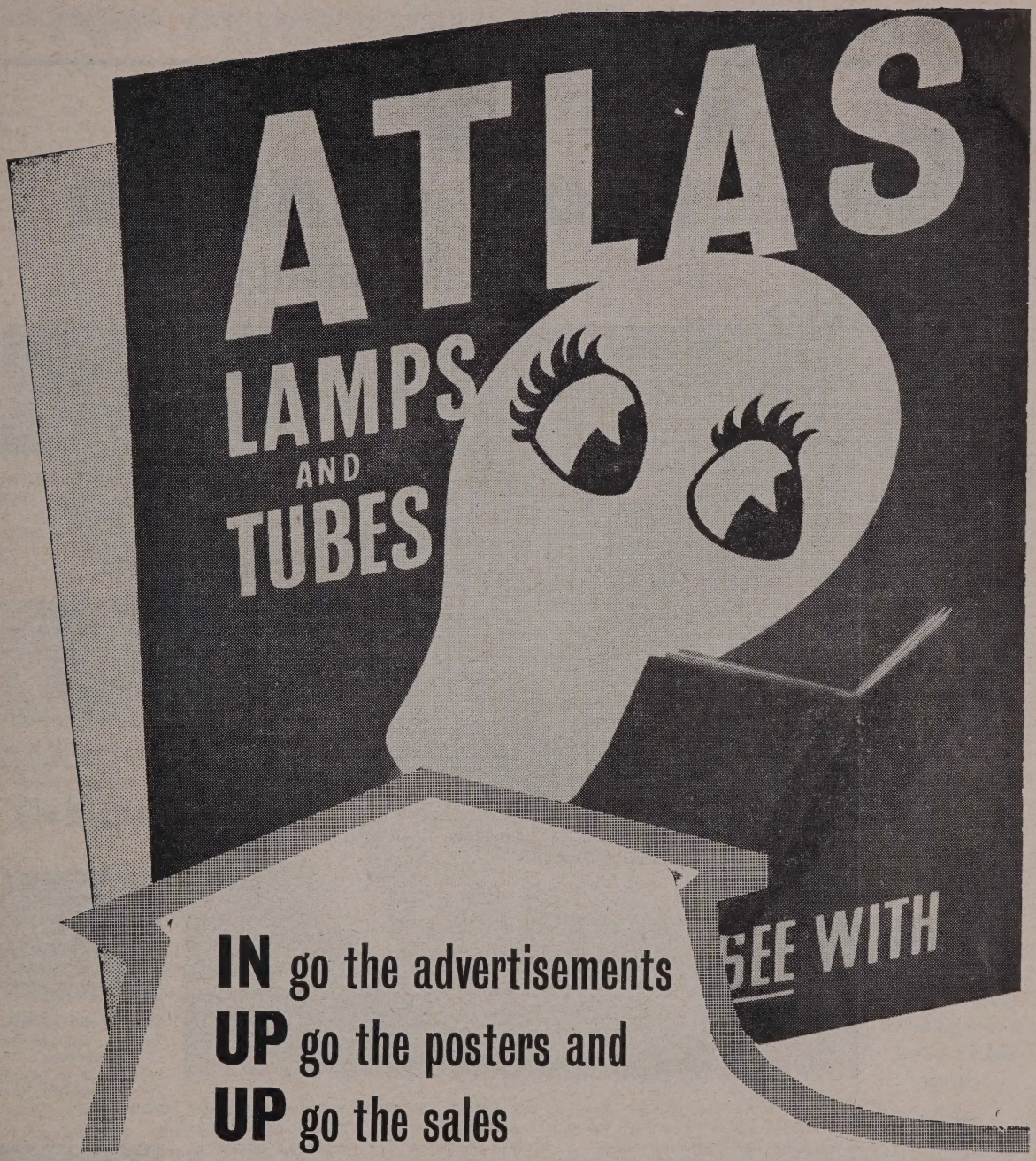

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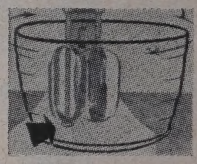

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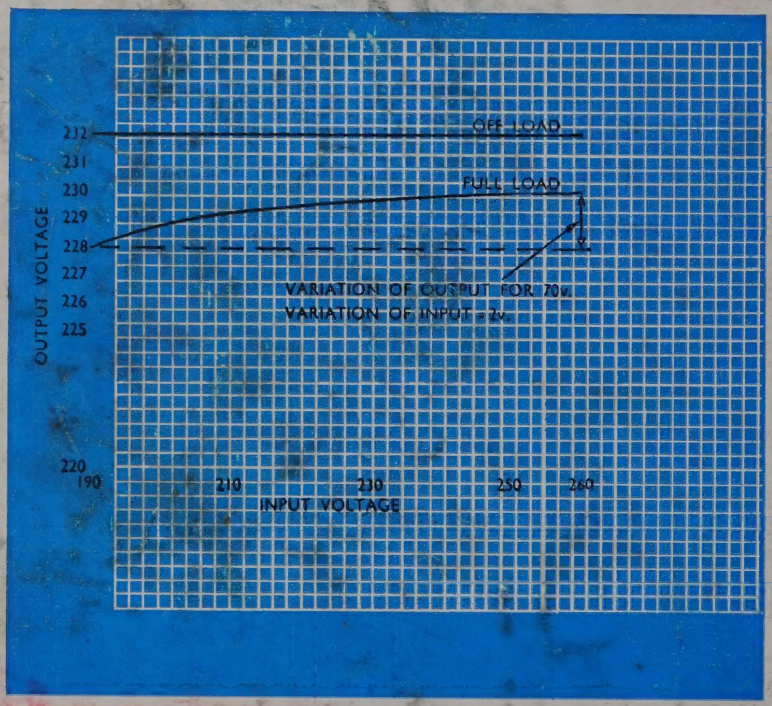

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